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TLP STATUS		
Intended for		**Detail**
Red	☐	Highly sensitive, non-disclosable information
Amber	☐	Sensitive information with limited disclosure
Green	☒	Normal business information
White	☐	Public information

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Notice

Traffic and Delay Comparisons: All traffic and delay comparisons are between the reporting year (2018) and the previous year, unless otherwise stated.

NM Area: All figures presented in this report are for the geographical area that is within Network Manager's responsibility unless otherwise stated.

Summer season: Figures referring to the summer season in this report are for the period May to October (incl.), unless otherwise stated.

Reporting Assumptions and Descriptions: For further information on the NM Area and the regulation reason groupings, go to the Reporting Assumptions and Descriptions document[i] available on the EUROCONTROL website.

Abbreviations: Abbreviations and acronyms used in this document are available in the EUROCONTROL Air Navigation Inter-site Acronym List (AIRIAL)[ii].

1 EXECUTIVE SUMMARY

There were on average 30,168 daily flights in the NM area in 2018, an increase of 3.8% compared to 2017, reaching a total of over 11 million flights. The previous year's trend of high growth was maintained. Overall, traffic remained within the low-high range of the forecast used in the planning phase.

Traffic growth was particularly high in the south-east axis, with ACCs in Central and Eastern Europe having record traffic levels. The busiest day ever in the network was Friday 7 September with 37,088 flights. There were nineteen days with over 36,000 flights (none in 2017).

Airline reported delays (all causes) reached 14.7 minutes per flight, an increase of 2.3 minutes compared to 2017.

En-route ATFM delay was 1.73 minutes per flight, double the delay of 2017 (0.88 min/flt in 2017) and well above the 0.5 minute per flight target. The high levels of demand, a major drop in capacity at two centres in the core area (Karlsruhe UAC and Marseille ACC) and a record number of adverse weather events and industrial actions severely disrupted the network in 2018.

Despite the high traffic growth in the network, airport ATFM delay was 0.60 minutes per flight, a 3% decrease compared to 2017. Weather and capacity accounted for 78% of the total airport delays in 2018. The highest airport ATFM delay generators were Amsterdam-Schiphol, Barcelona and Lisbon airports.

ATC capacity, en-route weather and ATC staffing were the main causes of en-route ATFM delay. Weather and staffing more than doubled compared to 2017. Delays attributed to disruptions and events had the highest increase with delays increasing more than 2.5 times.

Karlsruhe and Marseille combined caused 36% of all en-route ATFM delays. Limited capacity, recurrent staffing issues and disruptions impacted operations, including neighbouring ACCs. Maastricht, Reims, Brest and Vienna ACCs were the other centres with ATFM delay above 2,000 minutes per day.

NM and affected ANSPs prepared for the capacity issues at Karlsruhe well ahead of summer. The 4ACC initiative implemented a large set of measures aimed at diverting demand from risk areas. Demand effectively decreased by more than 2% on the UAC. Nevertheless, en-route delay at the UAC reached 3.18 minutes per flight in the summer. Moreover, aircraft flew at sub-optimal flight levels with a cost impact on operators.

Marseille ACC was affected by insufficient capacity. In addition, industrial action heavily impacted the ACC. Nineteen strike days with severe ATFM impact, including two national strikes were recorded in the ACC.

Unexpected capacity issues occurred in some ACCs in central and south-eastern Europe, partly driven by the high demand levels, namely in Vienna, Zagreb, Prague and Budapest ACCs.

A number of ACCs had lower delays than initially forecasted in the NOP. Bordeaux, Maastricht, Palma, Geneva, Amsterdam and London ACCs had been identified as having capacity short-comings for the summer, but successfully implemented the NOP measures and performed better than expected.

The year was marked by a record number of adverse weather events, especially CB cells, which started early in the summer and continued throughout the season, disrupting operations both on the ground and en-route. As a result, regulation delays allocated to weather have doubled comparing to 2017, and were one third of all ATFM delays.

On 3 April NM suffered an outage of its technical system affecting primarily its ATFM and CCAMS operational services. The outage of ETFMS resulted in the application of the NM ATFM Procedural Contingency Plan, which was correctly executed through all phases. Whilst this ensured a safe level of traffic throughout the European ATM Network, it had a negative impact on network performance.

The flight plan indicator (KEP) improved again in 2018, but at a slower rate than in 2017. The actual trajectory indicator (KEA) decreased slightly over 2017. During the spring 2018 KEA almost reached the target, deteriorating significantly afterwards due to capacity, weather and industrial action reasons.

There were record numbers of ATFM regulations in the NM system with over 400 regulations applied on some days. ATFM regulation usage (en-route and airport) increased generating delay for over 1.3 million flights.

ACCs reported an increase of traffic volatility. Fluctuations in tactical traffic counts made it difficult to manage operations. Airports also reported departure sequence issues due to the amount of updates to take off times. Similarly, airline operations experienced increased workload due to frequent updates of CTOT.

NM’s efforts to reduce delays through re-routeing proposals or direct actions from the NMOC increased in 2018. NM delivered en-route delay savings of 12.5% (2.7 million minutes). The NMOC received a high number of helpdesk requests (40% increase on 2017) with a peak of 2,444 requests on a single day (28 July).

2 INTRODUCTION & SCOPE

The purpose of this document is to provide an overview of the European ATM network performance in 2018 in the areas of traffic evolution, capacity offered by the Air Navigation Service Providers and Airports, delays and flight efficiency. Airspace users' opinion on the network performance is also included.

The report analyses the annual results in light of the main events that took place in the course of the year.

The document structure is as follows:

Section 1: Executive Summary.

Section 2: Introduction & Scope.

Section 3: Network Overview contains the annual performance of the European ATM network: traffic, delays and flight efficiency.

Section 4: Traffic in Detail is a detailed analysis of traffic growth in 2018 in the NM area and adjacent regions.

Section 5: En-Route Performance is an analysis of network en-route performance: events and disruptions; capacity and ACC performance.

Section 6: Airports is an analysis of the performance of airport operations.

Section 7: Flight Efficiency is an analysis of network flight efficiency.

Section 8: Network Manager is NM's contribution to achieved performance results.

Section 9: ATFM Compliance provides a view on the compliance to the ATFM Implementing Rule.

Section 10: References.

Annex I: Airspace Users' View outlines the users' perspective on how the network performed in 2018.

Annex II: ACC contains a traffic and capacity evolution for each ACC in 2018.

Annex III: Airports contains capacity, delay, arrival/departure punctuality status and a NM performance assessment of each of the significant airports in 2018.

3 NETWORK OVERVIEW

3.1 2018 BY MONTH

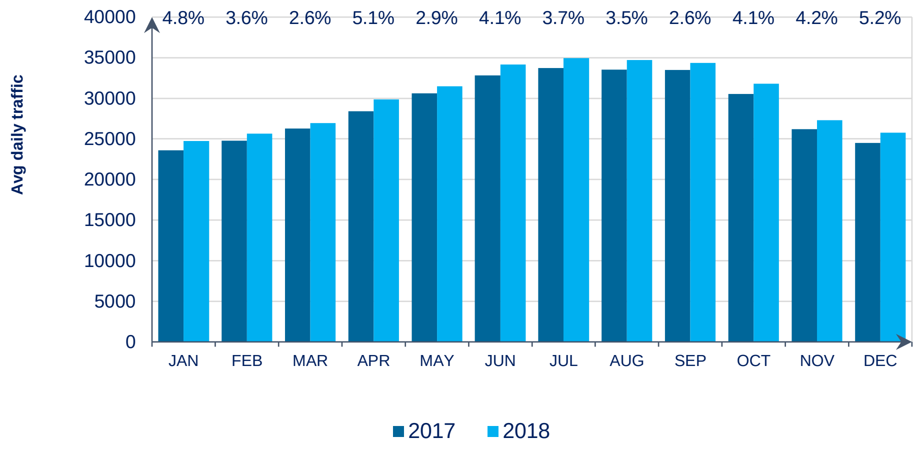


Figure 1: Average daily traffic in 2018

The first months of 2018 were slightly better than 2017 in terms of ATFM delay. The rest of the year, especially the summer months, was marked by record levels of en-route ATFM delay, largely due to the capacity limitations in two main ACCs of the core area – Karlsruhe and Marseille ACCs.

At the end of March, a national strike in France was the first of a series of French industrial actions with severe ATFM impact in the network. Most of the actions happened in Marseille ACC, which alone recorded 19 days of strikes until the end of June. By then, more than 20% of all ATFM delays on the network were due to industrial action.

With the start of the IATA summer season two additional airports joined A-CDM. Naples airport became a full CDM airport at the end of March and Amsterdam/Schipol joined A-CDM later in May.

On the 3 April NM suffered an outage of its technical system affecting primarily its ATFM and CCAMS operational services. The outage of ETFMS resulted in the application of the NM ATFM Procedural Contingency Plan, which was correctly executed through all phases.

The arrival of the summer schedules in April brought additional traffic growth and exposed the drop in capacity at Karlsruhe (20% reduction on sectors compared 2017). The network introduced in May a series of measures to divert traffic from the critical areas (4ACC initiative). These measures were active throughout the whole summer.

The month of May marked the early start of the convective weather season, which continued until mid-September. There were adverse weather events affecting most parts of Central and Eastern Europe during the whole summer, disrupting operations both on the ground and en-route.

As from the end of June, Marseille strikes ceased but the capacity and staffing delays on the ACC increased to unprecedented levels. In July, Marseille recorded a peak of 5.2 minutes of ATFM delay per flight. Despite the decrease in demand, Karlsruhe also reached an all-time peak of 4.31 minutes of delay per flight that month. Significant capacity problems were also occurring in the neighbouring ACCs of Maastricht, Reims and Vienna.

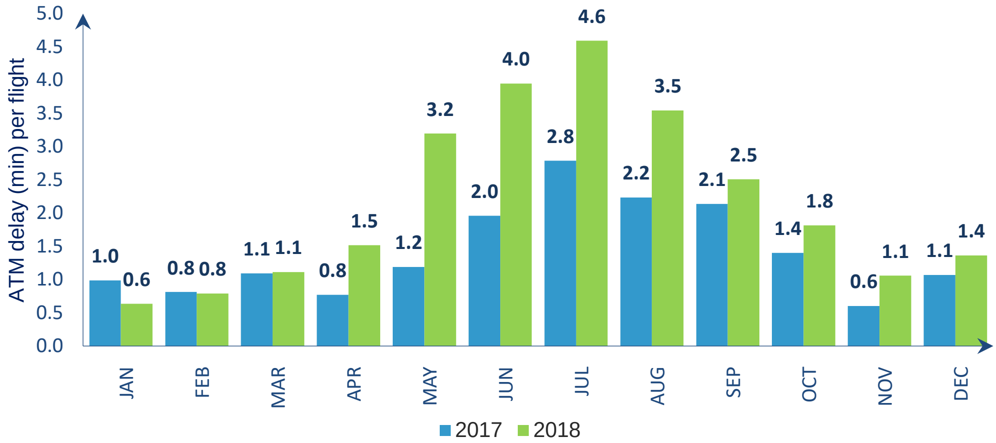


Figure 2 Monthly ATFM delay in 2018

The busiest day ever in the network was recorded on Friday 7 September with 37,088 flights. Nevertheless, September was the month with the lowest traffic growth. Overall network delay started to decrease, mainly due to an improvement of the staffing situation in Marseille and better weather conditions.

Karlsruhe and Marseille were still generating considerable ATFM delay in the last quarter of 2018. Lisbon and Canarias ACCs experienced some capacity issues during this period, partly due to the record traffic on the flows to the Spanish Atlantic islands. For the first time since February, airport ATFM delays were greater than en-route. Adverse weather affected many airports in the network, with high impact in London/Heathrow and Amsterdam/Schiphol.

In December, another French ATC strike impacted network operations. The figure of 11 million flights was reached on the last day of 2018, marking an all-time record for the network.

3.2 TRAFFIC 2018

There were on average 30,168 daily flights in the NM area in 2018 (Figure 3), an increase of 3.8% compared to the previous year, reaching a total of over 11 million flights. The summer months of June, July, August and September totalled more than one million flights each. There were 19 days with over 36.000 flights (none in 2017). Traffic growth was in line with February 2018 forecast.

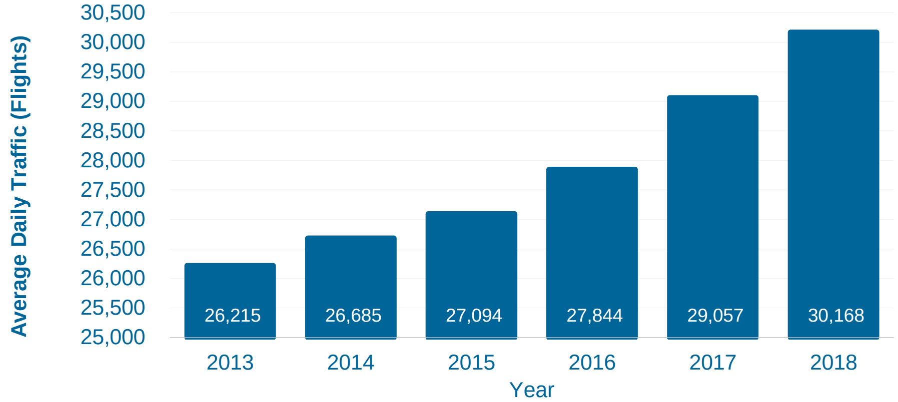


Figure 3: Average daily traffic per year

Germany, Spain and Turkey were the main contributors to the increase in traffic in the network. The south-east axis had particularly high growth, with most of the ACCs in Central and Eastern Europe recording growth levels near or above 7%. This was mainly due to the increase in flows to Turkey and Greece (especially from Germany) and a recovery of Russian traffic to Mediterranean destinations. The south-west axis recorded a more moderate growth compared to 2017, mainly due to a decrease in UK traffic.

3.3 DELAYS

3.3.1 ALL AIR TRANSPORT DELAYS (AIRLINE VIEW)

This section presents the all air transport delay situation by using the data collected by Central Office for Delay Analysis (CODA) from airlines. Data coverage is 70% of the commercial flights in the ECAC region for 2018.

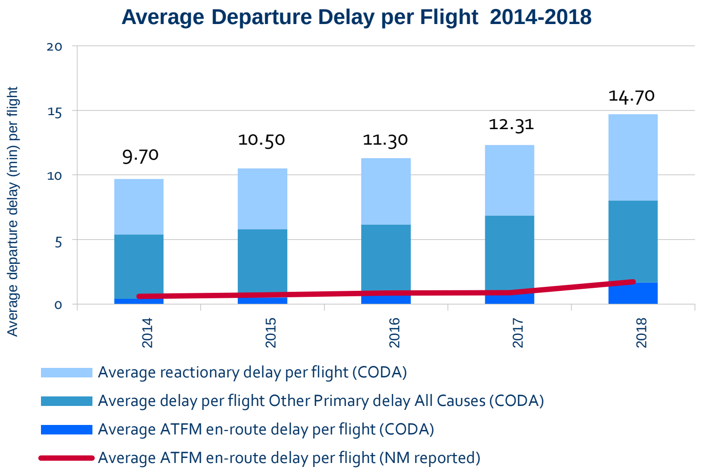


Figure 4 Average departure delay per flight 2014-2018

Based on airline data, the average departure delay per flight from 'All-Causes' was 14.7 minutes per flight, an increase of 17% in comparison to 2017 where the average delay was 12.31 minutes per flight (Figure 4). Primary delays accounted for 55% (or 8.02 min/flt), with reactionary delays representing the smaller remaining share of 45% at (6.68 min/flt), as shown in Figure 5.

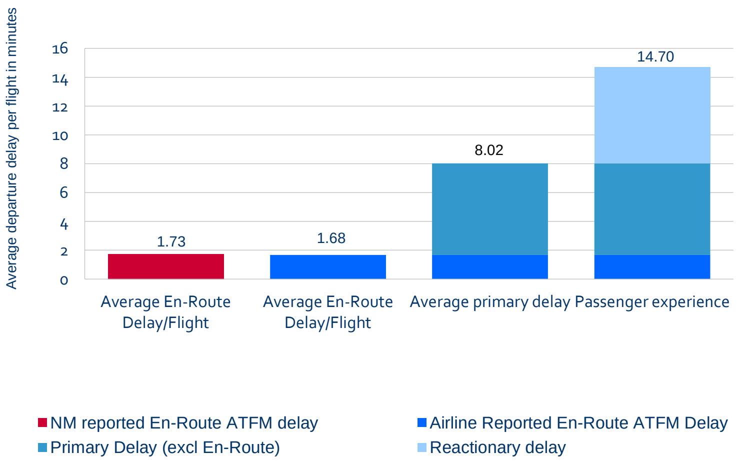


Figure 5 Average departure delay per flight 2014-2018

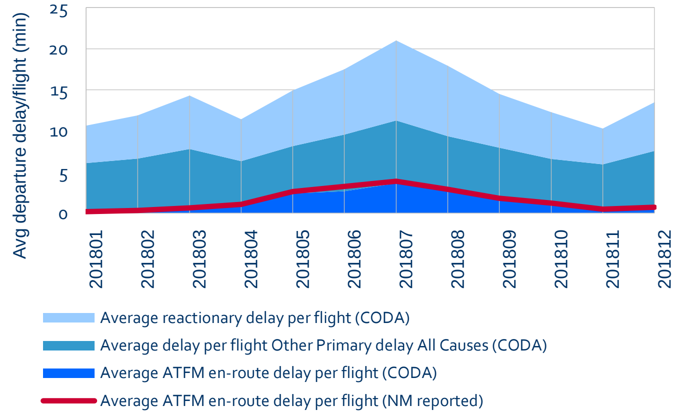


Figure 6: Average departure delay per flight 2018

Further analysis of the past 12 months (Figure 6) shows that the average 'All-Causes' en-route ATFM delay reported by airlines was 1.68 minutes per flight. This is lower[1] when compared to the NM reported average en-route ATFM delay of 1.73 minutes per flight in 2018.

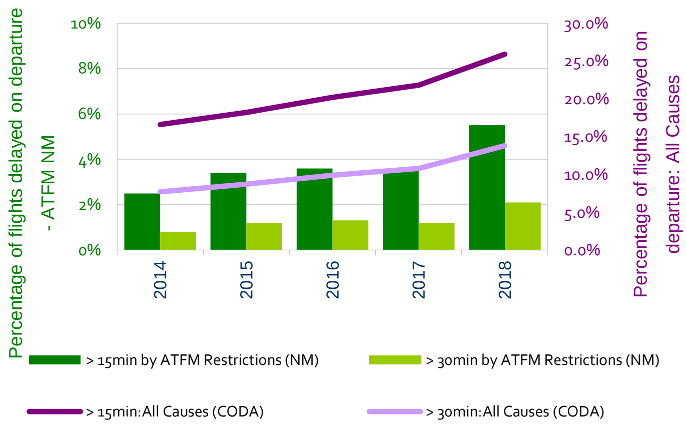


Figure 7: Percentage of delayed flights: ATFM & All Causes

The percentage of flights delayed from 'All-Causes' increased with those exceeding 15 minutes increasing by 4.1 percentage points to 25.9%. As shown in Figure 7, those exceeding 30 minutes also increased with 13.8% of flights being delayed in 2018.

[1] ATFM delays reported by airlines could be different than the NM calculated ATFM delays due to difference in methods: ATFM delays of NM are the (flight) planned "delays"; the airlines report the "actual" experienced ATFM delay on departure.

3.3.2 ATFM DELAYS

There were over 1.3 million flights delayed by an ATFM regulation in 2018, a 55% increase on 2017. One third of these flights was delayed by more than 15 minutes.

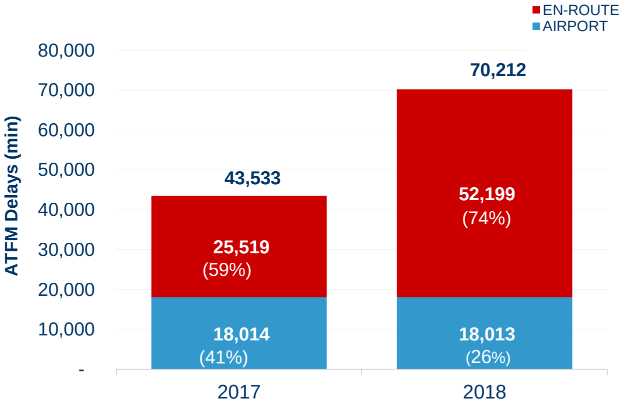


Figure 8 : Average daily ATFM delay (2017 vs 2018)

The average daily ATFM delay in 2018 increased by 61% compared to 2017. The en-route ATFM delay was the double of 2017 while airport ATFM delay remained at the same level of last year (see Figure 8).

The average ATFM delay per flight on the network was 2.33 minutes, a 55% increase compared to 2017 (Figure 9). En-route ATFM delay was 1.73 minutes per flight (97% increase) and airport ATFM delay was 0.60 minutes per flight (3% decrease). From 2015 to 2017, delay per flight remained stable at around 1.5 minutes per flight. The year of 2018 marked a change on the ATFM delay trend. The figure is now closer to the maximum of 2010 when the network recorded 2.88 minutes per flight. However, the traffic that year was 13% lower than 2018.

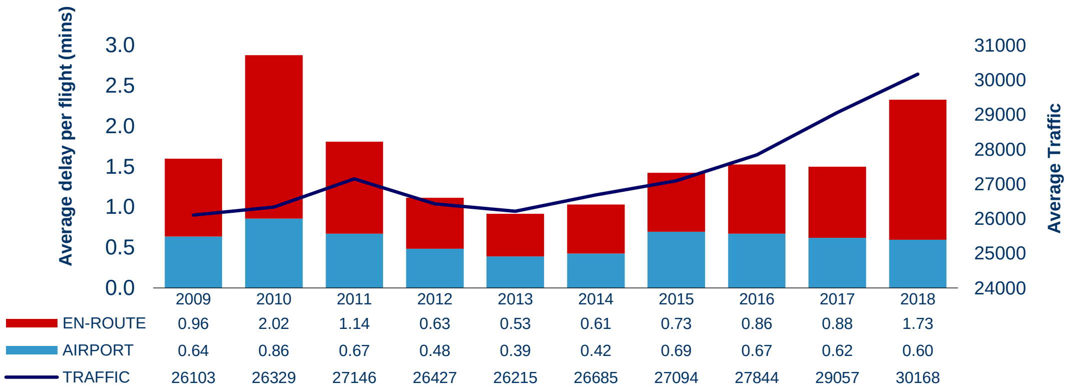
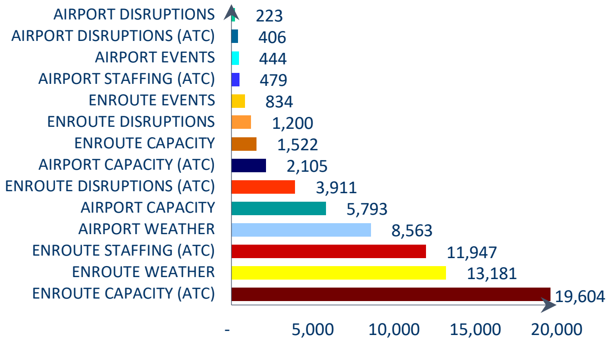


Figure 9 : Average daily traffic and ATFM delay per flight (En-route and Airport) 2009-2018



The main reasons for en-route ATFM delay in 2018 were en-route ATC capacity (28%), en-route weather (19%) and en-route ATC staffing (17%). Airport weather (12%) and airport capacity (8%) were the main delay causes attributed to airports (Figure 10).

Figure 10: ATFM delays in 2018 (av. daily)

Karlsruhe UAC and Marseille ACCs were the main generators of ATFM delay in the network (Figure 11). The same situation happened in 2017. Combined, the two centres generated nineteen thousand minutes of daily delay in 2018, which represents 27% of the total ATFM delay (Airport and En-route). Karlsruhe was greatly affected by en-route capacity and staffing while Marseille reported delays mainly due to en-route staffing and disruptions.

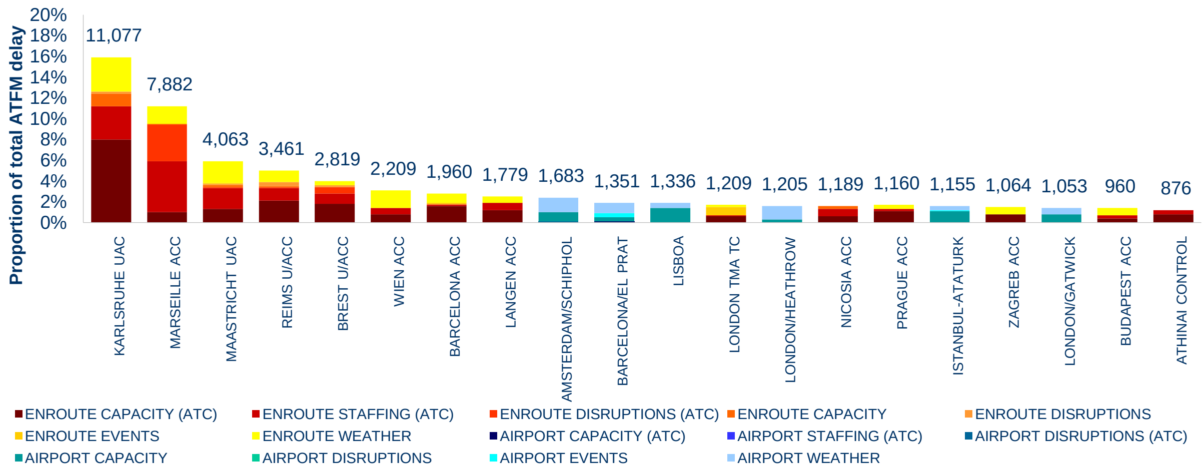


Figure 11 : Average ATFM delay per ACC in 2018

En-route ATC capacity was the main cause of delay in Reims, Brest and Barcelona ACCs, in addition to Karlsruhe. En-route ATC staffing had a great impact in Maastricht and Marseille ACCs. En-route weather affected several ACCs across the network, especially in Karlsruhe, Maastricht and Vienna.

Weather events affected the airports of Amsterdam/Schiphol, London/Heathrow, Barcelona, Frankfurt Main and Palma. The airports most affected by airport capacity were Lisbon, Istanbul/Ataturk and London/Gatwick, in addition to Amsterdam/Schiphol. Despite a decrease of 31%, the Dutch airport was the main generator of airport ATFM delay in the network.

There were several ATC industrial actions in France, especially between March and June, affected Marseille ACC and to a lesser extent, the other French ACCs.

3.3.2.1 EN-ROUTE ATFM DELAYS

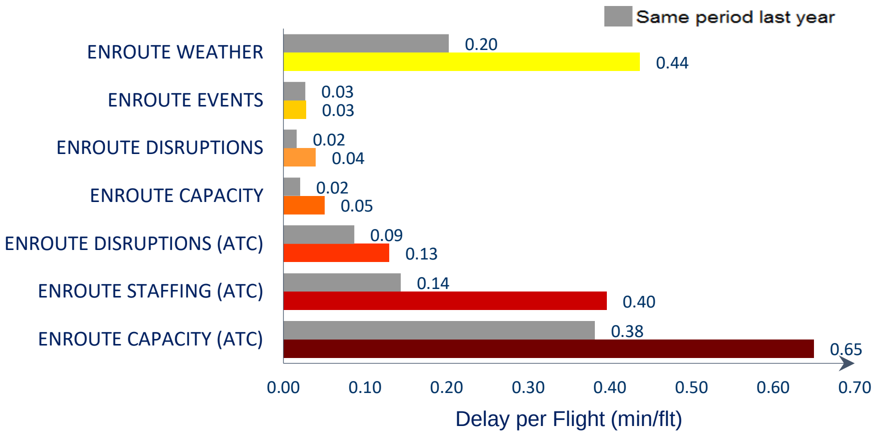


Figure 12: 2018 average en-route ATFM delay per flight

En-route delays in 2018 were the double of the previous year. This represents 9.7 million more minutes of en-route delay than 2017. En-route capacity delays increased 77% and en-route weather increased 116% (Figure 12). En-route staffing had the highest increase, 175%. Delays due to en-route disruptions and en-route events increased by 71%.

An overview on the performance of individual ACCs is available in 5 En-Route Performance and in Annex II - ACC.

3.3.2.2 AIRPORT/TMA ATFM DELAYS

Despite the traffic growth recorded on the network, airport ATFM delay remained at the same level as 2017, averaging 18,013 minutes of daily delay. Weather and capacity accounted for 79.7% of the total airport delays in 2018.

Airport weather related delay increased by 2.3% and remained the main airport delay cause. The airport with the highest weather delay, Amsterdam/Schiphol, generated an average of 999 minutes per day in 2018 compared to 1,337 in 2017. Adverse weather delays also decreased by 23.3% at London/Heathrow (912 minutes per day), but nearly doubled at Barcelona (715 minutes per day). Adverse weather conditions particularly affected airport operations in January, May, June and October.

Airport capacity delay decreased by 14.1% but remains the second biggest contributor to airport delay. Airport capacity related delay has decreased for the third consecutive year. Lisbon airport had the most capacity related delay in 2018, followed by Istanbul/Atatürk and Amsterdam/Schiphol airports.

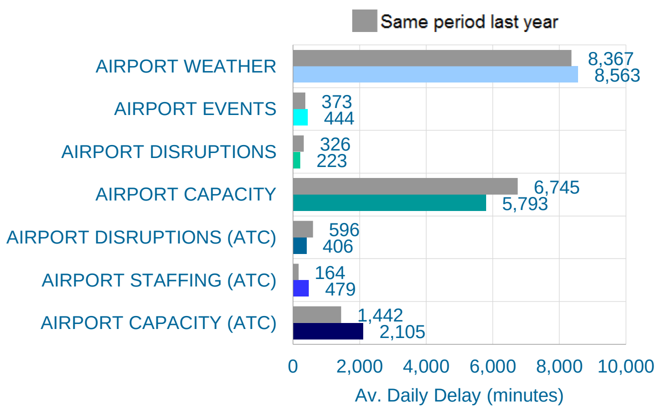


Figure 13: 2018 average daily airport/TMA delays

ATFM delays due to airport capacity (-20.2%), airport disruptions (ATC) and airport disruptions decreased compared to 2017 (Figure 13).

There was an increase in ATFM delays related to airport weather (+2.3%), airport capacity (ATC), airport staffing (ATC) and airport events.

During 2018, NM continued to provide support and recommendations to major airports facing local capacity challenges and/or high delay levels. NM gave special attention to specific regions and airports, with special focus on Barcelona airport and the Greek Action Plan. The airport function within the NMOC provided tactical support to hot-spot airports (see 6.3.1 Greek Islands – Summer).

An overview and more information on individual airports can be found in section 6 Airports and in Annex III - Airports.

3.4 FLIGHT EFFICIENCY

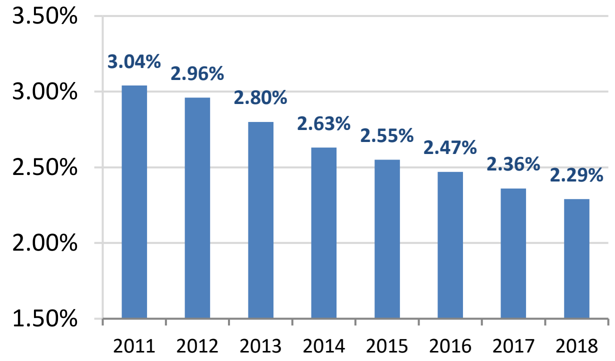


Figure 14: Average route extension due to airspace design (RTE – DES)

The average route extension due to airspace design decreased from 2.36% in 2017 to 2.29% in 2018 (Figure 14), exceeding already the target set for 2019 (2.39%). The indicator reached a historically low level in August 2018 with 2.23% and allowed potential average savings of nearly 2,100 nautical miles per day.

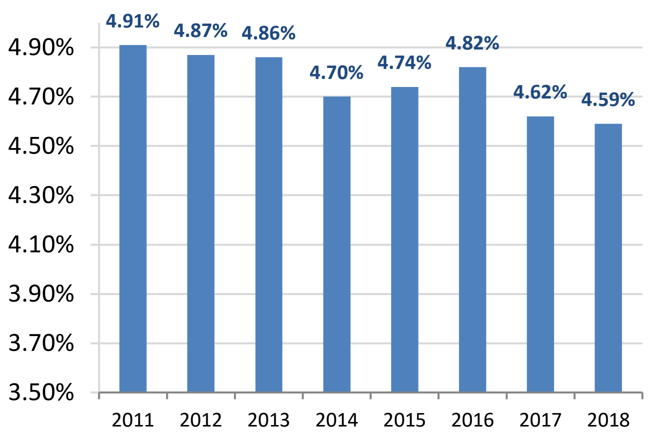


Figure 15: Yearly evolution of flight-planning indicator (KEP)

The flight planning indicator (KEP) measures the average route extension based on the latest filed flight plan. It decreased from 4.62% in 2017 to 4.59% in 2018 (for the NM area). The targets of 4.27% for SES area, 3.99% for NM area were not met (Figure 15).

The indicator decrease shows potential losses of approximately 3.67 million nautical miles.

Despite an improvement on flight plan efficiency (KEP), aircraft are flying longer routes (great circle distances increased by 2.3% on 2017, an increase of 12 nautical miles per flight) which impacts negatively the total route extension distance in 2018 in comparison with 2017.

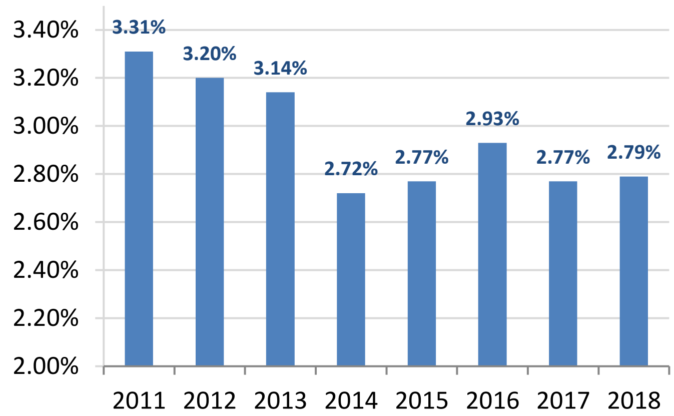


Figure 16: Yearly evolution of the actual trajectory indicator (KEA)

The actual trajectory indicator (KEA) increased to 2.79% (Figure 16) for the NM area, thus not meeting the target (2.69%).

The indicator increase represents an actual increase of approximately 5.7 million additional nautical miles flown.

4 TRAFFIC IN DETAIL

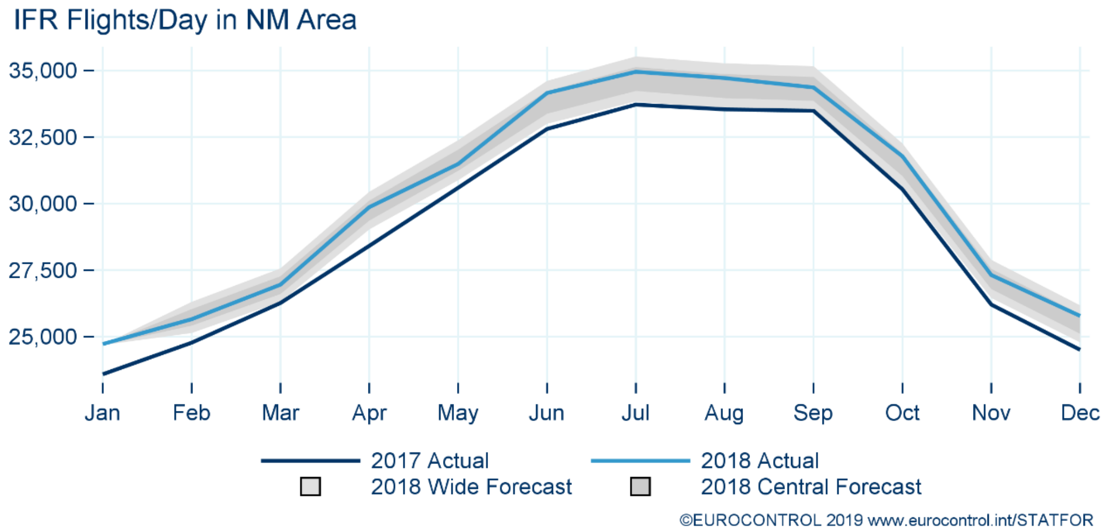


Figure 17 : IFR Flights per day in NM Area

In 2018, the number of flights in NM area increased by 3.8% compared to 2017, driving the total number of flights above 11 million, an all-time record. Traffic growth during the summer months was in line with the high growth scenario of February 2018 forecast (see Figure 17).

On average, there were 30,168 flights per day on the Network, and the busiest day ever was on 7 September when 37,088 flights were controlled. In fact, there were 19 days in 2018 with over 36,000 flights – there were none in 2017. Across 2018, the second and the last quarters recorded higher than average growth rates (compared to 2017); the last quarter's growth was particularly inflated due to heavy cancellations in 2017 (airline failures and snow).

The overall positive trend in 2018 however hid some local disparities: Germany and Spain were the busiest contributors to the local traffic growth in Europe while UK and Sweden recorded losses in their respective local traffic.

Airlines maximised their load factors and the total number of passengers carried reached record heights. This was due to strong demand and planning of operations when fuel costs were low at the end of 2017.

4.1 NETWORK CONTRIBUTORS

Figure 18 shows the main contributors to traffic growth in 2018 (referring to local traffic only, ie. excluding overflights). All but two states (Sweden and UK) have been adding flights to the network in 2018. The three main contributors to the network's local traffic were Germany, Spain and Turkey.

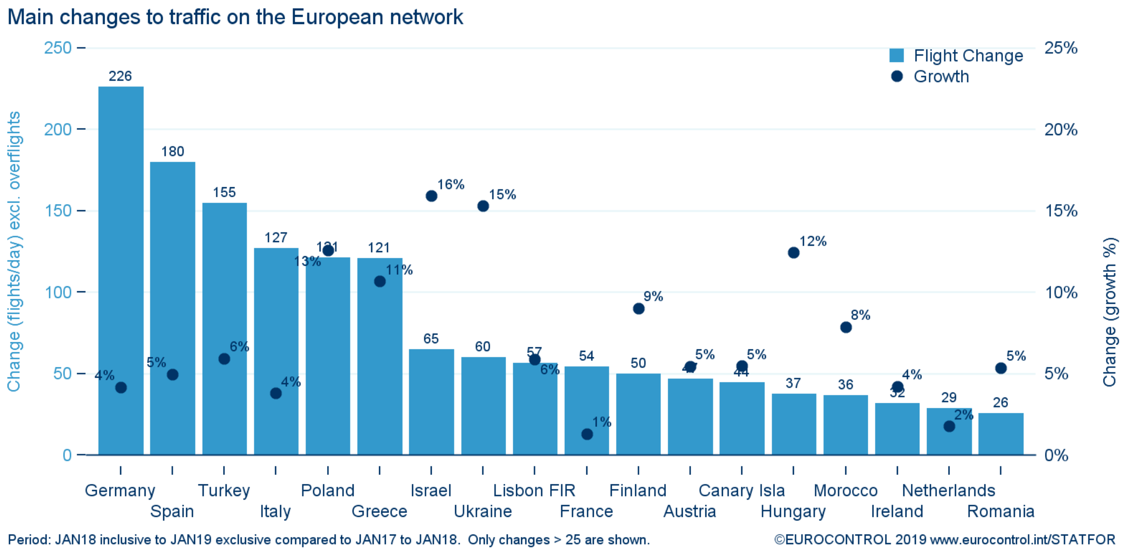


Figure 18: Main contributors to network growth (excl. overflights) in 2018.

Germany (+226 flights/day) recorded especially strong growth on the flows from and to Mediterranean states (Turkey, Spain, Greece as well as Egypt). However, growth rates were artificially inflated in the last quarter of the year due to the counter effect of airberlin cessation of operations in October 2017.

Spain was the second biggest contributor (+180 flights/day) owing to a particularly dynamic domestic flow and strong growth from and to Germany. Turkey was the third main contributor (155 flights/day), stimulated by the continuing traffic recovery from and to the Russian Federation as well as strong growth from and to Germany. Growth was held back by weak domestic flows.

Italy (127 flights/day) ranked fourth, notably due to strong traffic from and to Spain and from and to the Russian Federation. Poland (121 flights/day) completed the top five owing to strong growth on flows from and to Ukraine, Germany and Turkey.

At the other end of the scale, Sweden and UK saw declines of their local traffic. UK recorded a general decrease on its busiest flows: Spain, Germany, France, Netherlands, Switzerland and Canary Islands.

4.2 ROUTING ASPECTS

The year of 2018 was marked by changes in traffic patterns: some flights have used different routes compared to the ones used in 2017, mostly because airlines optimised their routes and the network was also continuously refined, for example, recently with the development of free route airspace. Moreover, during Summer 2018, the Network Manager launched a joint initiative with a group of ANSPs, the “4 ACCs initiative”, to optimise[2] the flows of traffic through the participant ACCs’ airspaces as a whole, so as to increase overall capacity and throughput.

This affected the ACCs in the core area of the network, with impact on the flight routings and flight levels, on the distance flown and on the aircraft weights. As an example, flows between North-West European States (Germany, UK, Belgium/Luxembourg or France) and Italy, were routed more through Switzerland in 2018 while the year before they were routed more through Austria.

When comparing 2018 routings to 2017 ones, other route changes on bi-directional flows at State level include:

- Flows between North-West Europe States (Germany, UK) and Turkey have been routed more via southern routes along the Adriatic coast (Croatia, Bosnia-Herzegovina, Serbia, Montenegro, Greece) than the northern routes used in 2017 (Czech Republic, Slovakia, Hungary, Romania, Bulgaria)
- Flows between Germany and Egypt have been routed more through eastern routes (via Czech Republic, Turkey, Cyprus) than through the 2017 routes along the Adriatic coast (via Croatia, Albania)
- Flows between North-Atlantic and Middle-East have been routed more through southern routes (via UK, Ireland, Bulgaria, Turkey) than northern routes (via Iceland, Norway, Sweden, Finland and Russian Federation), partly due to the changed jet stream position during the year
- Flows between UK and Canary Islands have been more routed through France, Spain and Morocco than via the Atlantic routes (Ireland, Santa Maria)
- Flows between Italy and Middle-East have been routed more through Bosnia Herzegovina, Bulgaria and Turkey than through southern routes (Greece, Cyprus).

[2] In practice: a new ATS route has been opened in Poland to ease the passage of traffic between northern and southern Europe, local measures have been introduced to reduce the demand in Karlsruhe UAC and Maastricht UAC and some RAD (Route Availability Document) measures have been adopted to lower the network delay and minimise the route extension.

4.3 OUTSIDE EUROPE

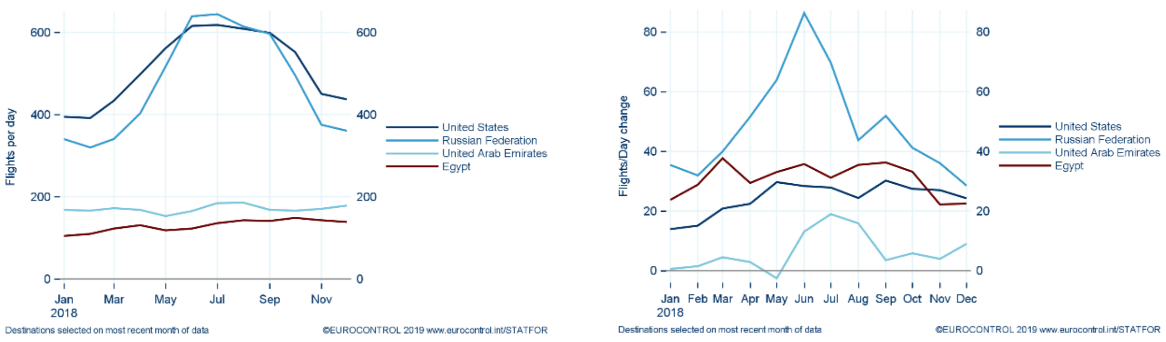


Figure 19: Top 4 extra-NM partners in 2018. Left: number of flights per day (unidirectional). Right: additional number of flights per day in 2018 (vs 2017).

As shown in Figure 19, the United States remained the number one external[3] destination from Europe in terms of number of flights with ~1,030 flights per day on average in 2018 (both directions), which is a growth of 5% on 2017.

The Russian Federation was the second destination from Europe with ~940 flights per day, continuing its recovery from the Russian economic slowdown (2014) with a 11.4% growth per day on average. During summer months (June-August), Russia traffic grew even more strongly and became the number one destination, overtaking the United States.

The third destination from Europe remained United Arab Emirates, with an average daily traffic of 340 flights (+4% on 2017). Egypt is the fourth destination from Europe, slowly recovering from its extended decline (2011 and 2015) with ~260 flights per day, a 31% increase on 2017 but still 15% below 2010 levels (See Figure 19).

[3] Europe = ECAC. Morocco and Israel are considered as external partner (though they belong to NM area)

4.4 AIRPORT TRAFFIC EVOLUTION

Departures from the airports in the network increased by 3.4% in 2018.

Nº	ICAO ID	AIRPORT NAME	DEP	%
1	EDDF	FRANKFURT MAIN	701	7.7%
2	EHAM	AMSTERDAM/SCHIPHOL	701	0.7%
3	LFPG	PARIS CH DE GAULLE	669	1.2%
4	EGLL	LONDON/HEATHROW	654	0.3%
5	LTBA	ISTANBUL-ATATURK	625	1.1%
6	EDDM	MUENCHEN	562	2.0%
7	LEMD	ADOLFO SUAREZ MADRID-BARAJAS	561	5.7%
8	LEBL	BARCELONA/EL PRAT	460	3.8%
9	LIRF	ROMA/FIUMICINO	421	3.4%
10	EGKK	LONDON/GATWICK	389	-0.8%
11	LSZH	ZURICH	372	3.1%
12	EKCH	KOBENHAVN/KASTRUP	365	2.8%
13	ENGM	OSLO/GARDERMOEN	353	2.6%
14	LOWW	WIEN SCHWECHAT	351	6.7%
15	ESSA	STOCKHOLM-ARLANDA	334	-2.1%
16	EIDW	DUBLIN	318	4.3%
17	LFPO	PARIS ORLY	318	0.0%
18	EBBR	BRUSSELS NATIONAL	315	-1.3%
19	LTFJ	ISTANBUL/SABIHA GOKCEN	309	5.5%
20	LEPA	PALMA DE MALLORCA	302	5.6%
21	EDDL	DUESSELDORF	299	-1.3%
22	LPPT	LISBOA	298	7.2%
23	LGAV	ATHINAI/ELEFTHERIOS VENIZELOS	289	11.2%
24	EGCC	MANCHESTER	276	-1.1%
25	EGSS	LONDON/STANSTED	274	6.2%

Nº	ICAO ID	AIRPORT NAME	DEP	%
26	LIMC	MILANO MALPENSA	266	8.6%
27	EFHK	HELSINKI-VANTAA	264	9.1%
28	EPWA	CHOPINA W WARSZAWIE	257	9.4%
29	LTAI	ANTALYA	255	20.9%
30	EDDT	BERLIN-TEGEL	254	8.1%
31	LSGG	GENEVA	247	-2.0%
32	LLBG	TEL AVIV/BEN GURION	214	13.2%
33	LKPR	PRAHA RUZYNE	207	5.1%
34	EDDH	HAMBURG	204	-3.3%
35	LFMN	NICE-COTE D'AZUR	197	1.0%
36	EDDK	KOELN-BONN	194	2.1%
37	LEMG	MALAGA/COSTA DEL SOL	188	1.6%
38	EGGW	LONDON/LUTON	186	0.5%
39	EGPH	EDINBURGH	177	1.7%
40	EDDS	STUTTGART	176	8.6%
41	GCLP	GRAN CANARIA	175	10.1%
42	LROP	BUCURESTI/HENRI COANDA	168	5.7%
43	LTAC	ANKARA-ESENBOGA	157	2.0%
44	LHBP	BUDAPEST LISZT FERENC INT.	157	12.1%
45	LIML	MILANO LINATE	156	-1.9%
46	LFLL	LYON SAINT-EXUPERY	155	0.7%
47	EGBB	BIRMINGHAM	151	-7.4%
48	EDDB	SCHOENEFELD-BERLIN	138	0.7%
49	LFBO	TOULOUSE BLAGNAC	134	-1.5%
50	LFML	MARSEILLE PROVENCE	134	0.0%

Table 1: Top 50 airports per average daily departure traffic in 2018

With a 7.7% traffic increase, Frankfurt/Main airport matched Amsterdam/Schiphol in terms of average daily departures in 2018. The two airports shared a traffic record of 701 average daily departures. With a 1.2% traffic increase, Paris Charles de Gaulle remains one of the top 3 busiest airports with 669 average daily departures.

Seven of the top ten airports (Frankfurt/Main, Paris/Charles de Gaulle, Istanbul/Atatürk, Munich, Madrid/Barajas, Barcelona/El Prat and Rome/Fiumicino) had an increase in average daily flights in 2018. Amsterdam/Schiphol, London/Heathrow and London/Gatwick, all capacity constrained, remained at similar levels as 2017.

The largest increase in traffic was at Antalya (20.9%), Tel Aviv/Ben Gurion (13.2%), Budapest (12.1%), Athens (11.2%), Gran Canaria (10.1%), Warsaw/Chopin (9.4%) and Helsinki (9.4%) airports also recorded significant traffic increase in 2018.

The cessation of operations of Monarch airlines and airberlin significantly affected the traffic at Birmingham and Hamburg airports, respectively. Birmingham recorded a traffic decrease of 7.4% while Hamburg had 3.3% less traffic.

4.5 AIRLINE INDUSTRY

The traditional scheduled market segment accounted for the highest number of flights in 2018 (52.5%), recording a growth of 4.5% (Figure 20). The low-cost segment had a 2.8% increase (30.3% market share), with an acceleration during the last quarter due to the 1-year post failure effect of some major carriers[4]. Due to the same reason, the traditional scheduled segment outgrew the low-cost segment for the first time since 2005[5].

The charter segment (3.9% market share) recorded a 14.4% increase starting the year with exceptionally high growth rates (linked to a recovery to Egypt and Tunisia).

Business Aviation, accounting for 6.6% of the European traffic, remained mostly flat (+0.6% in 2018 vs 2017), even if it started to decline from September 2018 across a broad range of geographic markets. Lastly, all-cargo flights (3% of the total traffic) recorded a 2.2% decline, linked to weakness in European manufacturers' export order books (particularly in Germany).

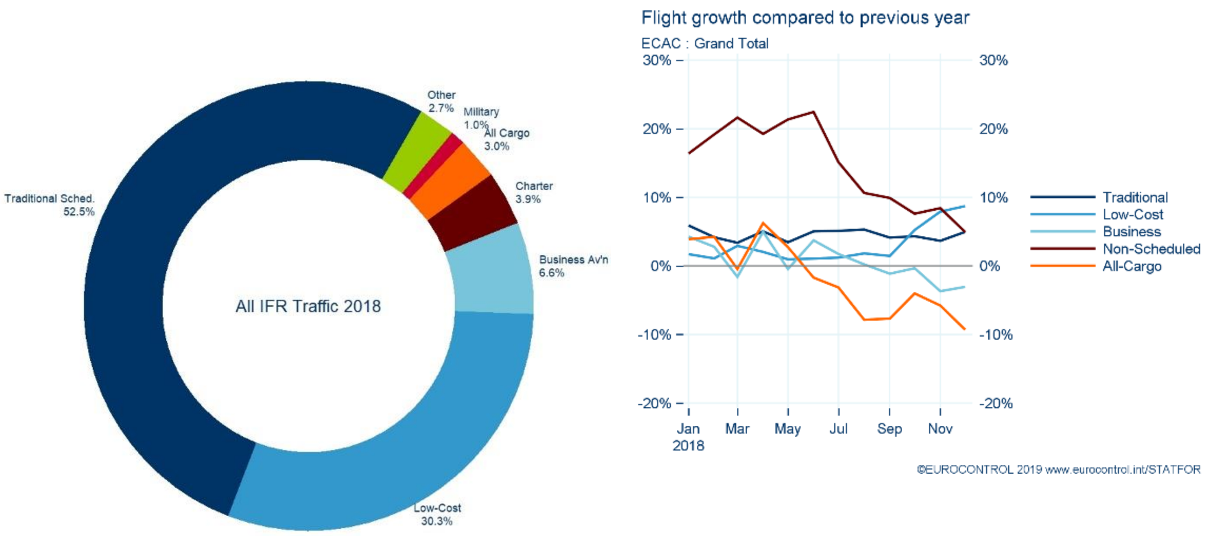


Figure 20: Left: Market Segment's share in 2018. Right: Market segment's growth in 2018.

Fuel costs were very variable during 2018 (Figure 21), which created issues for airlines. Oil prices averaged €60 per barrel in 2018. It started at around €55 per barrel in January 2018 but increased to €70 in early October before falling down to €50 at the end of the year as some big producers suddenly increased their crude oil production[6] to compensate for the anticipated decline of Iran oil exports (US sanctions).

[4] Airberlin, Monarch Scheduled, Niki Luftfahrt Gmbh
[5] 2005 was the first year STATFOR classified flights into Market Segments.
[6] Russia, Saudi Arabia, Kuwait, Iraq and the US

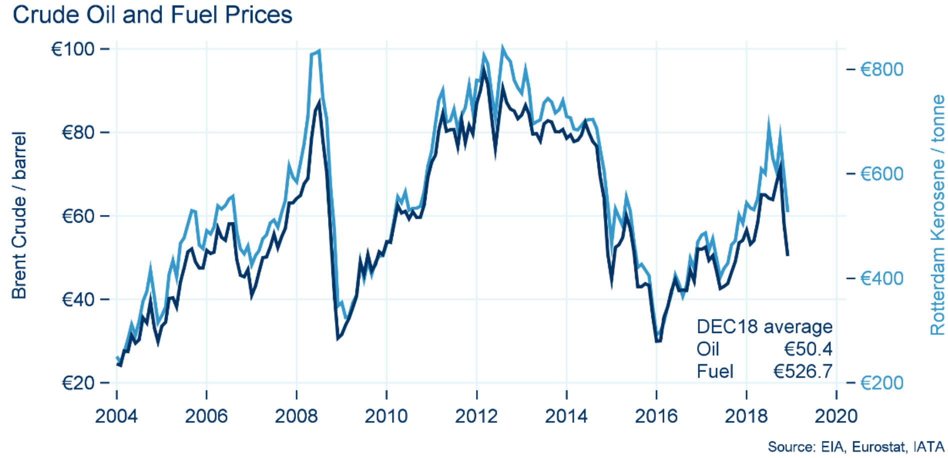


Figure 21: Crude Oil and Fuel Prices Evolution

Aircraft manufacturers delivered some new and more efficient aircraft such as B737 Max and A320neo. Boeing delivered 806 aircraft (20% in Europe) and Airbus delivered 800 aircraft (17% in Europe),

Airlines added capacity to the network in 2018, with fuel costs relatively manageable when they were planning (late 2017) and a favourable economic context. The Europe-wide available seat kilometres grew by 5.8% and the available freight tonne kilometres grew by 3.2% in 2018. Building on post-crisis efforts (restructuring and concentrating on filling-up the aircraft), European airlines posted passenger load factors of 84.8% (a 0.6 pp increase on 2017), the highest of all regions as Europe remains one of the most competitive area in the world. Freight load factors were at 54.3%[7].

Overall, the European airlines recorded net profits[7] of $7.5 billion in 2018, slightly less than in 2017 ($8.2 billion) and 2016 ($8.5 billion) as some concerns arose during the second half of the year: some European failures (e.g. Primera Air, PrivatAir), the challenges of offering new business models with new aircraft across the Atlantic affecting Norwegian and WOW, geopolitical tensions (US-China, amongst others) or; some mixed signs on the economic backdrop in the region (e.g. Germany).

[7] Air Passenger Market Analysis – Dec. 2018, IATA, February 2019 and Air Freight Market Analysis – Dec. 2018, IATA, February 2019.

4.6 FLIGHT REDUCTIONS

In 2018, the operational cancellation rate was 2.0% compared to 1.5% in 2017. Figure 22 shows the monthly operational cancellation rates.

Severe weather conditions (snowstorms) in UK, Ireland and across Western Europe throughout February and March (including winter storm Emma between 26 February and 05 March 2018) led to widespread flight cancellations. An Italian ATC industrial action on 08 March and a French ATC industrial action from 21 March to 23 March caused an increase in flight cancellations.

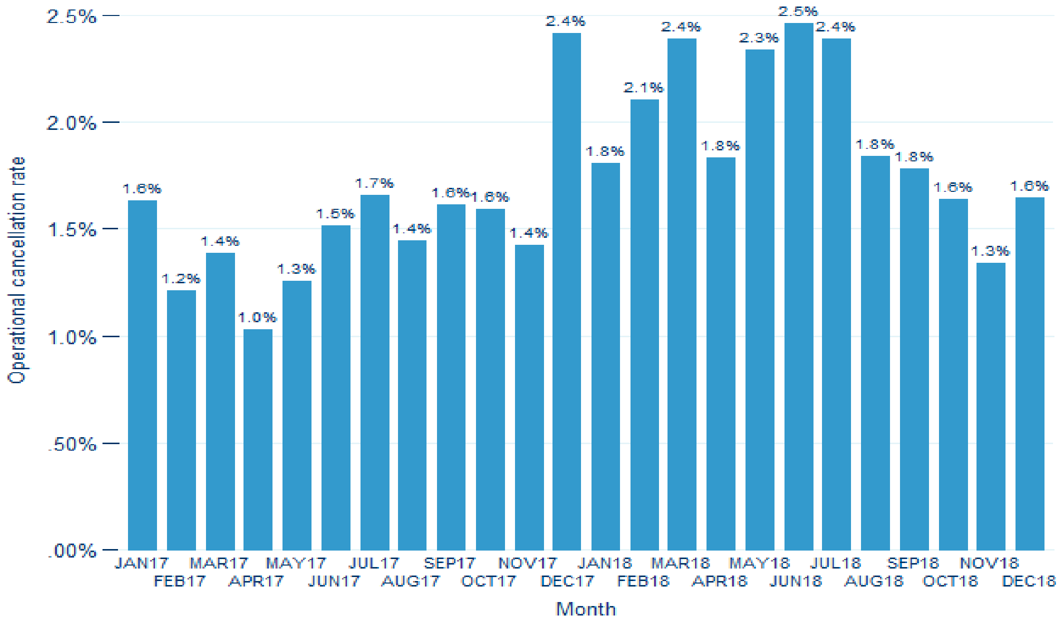


Figure 22 Monthly Rate of Operational Cancellations 2017-2018

Convective weather conditions (thunderstorms) affected large areas of North-Western Europe and French industrial actions throughout the second quarter of 2018 led to peaks in the daily operational cancellation rates.

In July, the FDPS failure in Brussels ACC (19 July) and a passenger terminal evacuation at Munich Airport on the 28 July led to significant number of cancellations.

Towards the end of the year cancellation rates returned to more standard levels, with only one industrial action in France on 14 December causing major disruption.

5 EN-ROUTE PERFORMANCE

5.1 HOT SPOTS

Figure 23 shows the top twenty en-route ATFM delay generating locations for 2018 with respect to total ATFM delays. Figures are in minutes and they represent the average daily delays for the individual locations.

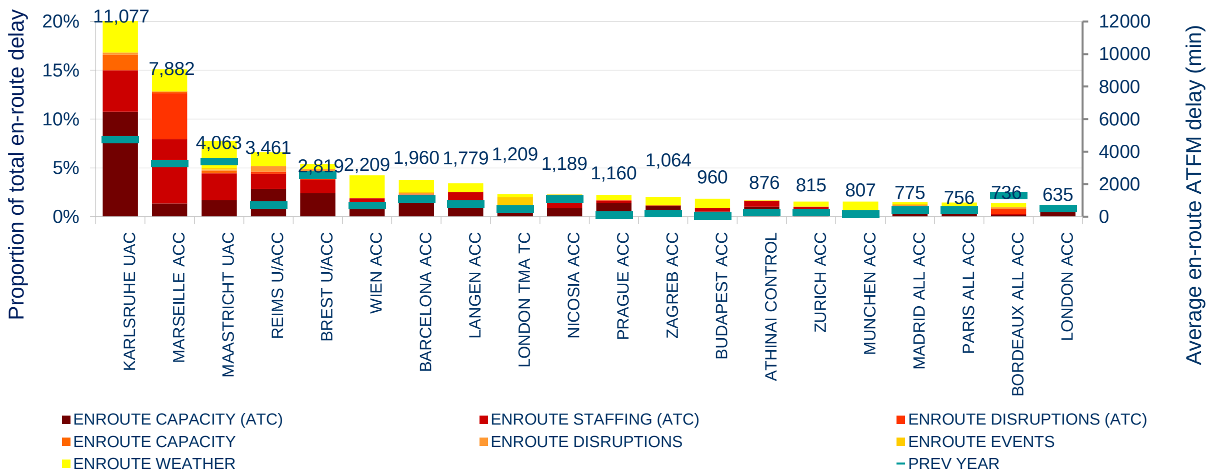


Figure 23: Top 20 en-route ATFM delay locations during 2018

The top twenty delay locations generated 88.5% of en-route ATFM delay in 2018. The top six locations (Karlsruhe, Marseille, Maastricht, Reims, Brest, Vienna) generated 60% of all en-route ATFM delay.

All the top six ACCs increased their ATFM delays compared to 2017. Reims had the highest increase with almost five times the figure of 2017. The only decrease in ATFM delay in the top 20 occurred in Bordeaux. The French ACC had been one of the bottlenecks of the network in 2017, but the situation improved significantly in 2018. For more details on the performance of these ACCs see section 5.3 ACC analysis.

Marseille, Karlsruhe, Reims and Nicosia had all more than 1 minute per flight (Figure 24) of en-route ATFM delay. Of the high delay ACCs only Brest, Nicosia and Maastricht managed to maintain similar levels of delay per flight as the previous year.

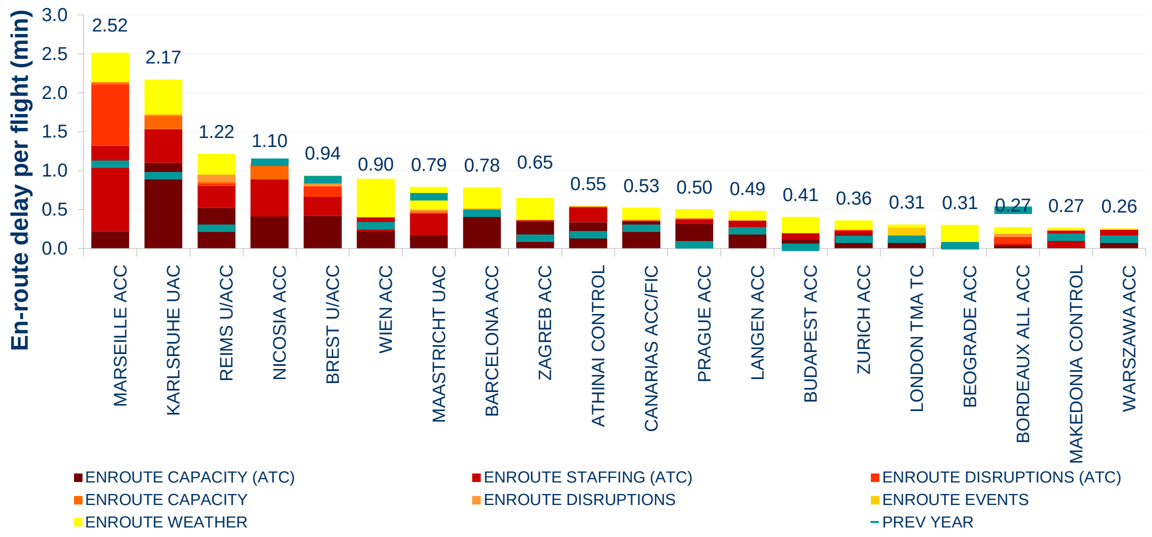


Figure 24: Top 20 en-route ATFM delay per flight locations during 2018

Of the top twenty delay locations, those with the largest increase were Budapest, Prague, Zagreb, Beograd ACCs. These ACCs had almost no ATFM delay in 2017.

En-route ATC capacity and staffing (61%) were the main reasons of en-route ATFM delay per flight for the top six ACCs followed by en-route weather (23%) and en-route disruptions and events (13%).

The network delay per due to en-route ATC capacity reasons was 0.65 minutes per flight. Two ACCs were above the network figure: Karlsruhe (1.10 min/flt) and Reims (0.52 min/flt). The other ACCs with high delays due to ATC capacity were Barcelona (0.44 min/flt), Brest (0.42 min/flt) and Nicosia (0.41min/flt).

En-route staffing issues affected mainly Marseille (1.10 min/flt), Nicosia (0.48 min/flt) and Karlsruhe (0.43 min/flt).

En-route delays due to weather affected mostly Vienna, (0.49 min/flt), Karlsruhe (0.45 min/flt) and Marseille (0.38 min/flt) ACCs.

En-route ATC disruptions and en-route events affected mostly Marseille (0.79 min/flt) and, to a lesser extent Brest (0.18 min/flt).

5.2 PLANNED EVENTS AND DISRUPTIONS

En-route ATFM delays due to planned events (system upgrades/transition projects) and disruptions increased by 71% in 2018 (see 3.3.2.1 En-Route ATFM Delays). In the following paragraphs there is an overview of the main events and disruptions in 2018.

5.2.1 EN-ROUTE PLANNED EVENTS

The introduction of electronic flight progress strip capability, into both the London TC Approach and London TC en-route operations, within London TC, project named EXCDS- Extended Computer Display System, continued in 2018 and went through its final implementation stage in July. The project generated some 204,360 minutes of ATFM delay on the course of seven months.

The upgrade of CANAC 2 ATM system in Brussels ACC generated 19,866 minutes of ATFM delay during a ten-day period.

London ACC, in partnership with Maastricht UAC and Amsterdam ACC implemented system changes to support introduction of new COPS on the interface boundary with the AC CLN sectors causing Maastricht UAC to generate 5,273 minutes of delay.

Maastricht UAC implemented Phase 2 of FRAM 2 project, further improvements of the Free Route Airspace operations within the UAC, and generated only 7,819 minutes of ATFM delay.

Geneva and Zurich ACCs deployed, during a three-day period, yet another step of the Virtual Centre program generating only 491 minutes of ATFM delay.

The projects mentioned above and listed in Table 2 had been subject of the transition planning process. No other projects from the list generated ATFM delay during the implementation phases. The table shows the system upgrade/transition projects that might have imposed capacity reductions in several ACCs and that were included in the NOP Transition Plans[iii].

Major Projects / Special Events[8]	January - March	April - June	July -September	October - December
UK – London TC				
Implementation of ExCDS	■	■	■	
Germany - Munich ACC				
OASE	■			
Germany - Munich ACC				
FRA	■			
Germany – Karlsruhe ACC				
FRA	■			
Germany – Bremen ACC				
FRA	■			
Maastricht – MUAC				
DECO Sectors		■		
Ireland – Shannon ACC				
ATM System upgrade		■		
Morocco – Agadir ACC				
New ATM system		■		
Switzerland – Geneva & Zurich ACCs				
Virtual center ODS 4.1				■
Belgium – Brussels ACC				
CANAC 2 upgrade				■
UK – London ACC				
SAIP AD4				■
UK – Prestwick ACC				
PLAS 3b				■
Maastricht – MUAC				
FRAM 2				■
Germany - Munich ACC				
OASE P2				■
Germany – Langen ACC				
2.0 on SF10				■

Table 2 System Upgrade / Transition Projects

[8] Does not include postponed projects and should not be considered as exhaustive

5.2.2 EN-ROUTE DISRUPTIONS

Industrial action was the main source of en-route disruptions in 2018, contributing to 7.7% of total en-route ATFM delay (including indirect delays in the neighbouring ACCs due to on-loading traffic). There were roughly 1.5 million minutes of ATFM delay attributed to strikes, representing a 85% increase when compared to 2017. Three French ATC industrial actions in March, May and December and several local actions at Marseille from April to June generated most of the ATFM delay allocated to strikes in 2018. NM estimates that operational cancellation rates were between 3%-8% on days with large-scale industrial action.

On the 03 April 2018 NM suffered an outage of its technical system affecting primarily its ATFM and CCAMS operational services. The outage of ETFMS resulted in the application of the NM ATFM Procedural Contingency Plan, which was correctly executed through all phases. This plan includes precautionary reductions in sector capacities and lower departure rates from airports. Whilst this ensured a safe level of traffic throughout the European ATM Network, by design it had a negative impact on network performance. Traffic patterns were disrupted but the number of cancelled flights was low.

Table 3 shows the unplanned events or disruptions[9] that imposed capacity reductions in certain ACCs in 2018.

Date	Location	Event	Traffic Impact (Cancellations)	ATFM Delay Impact
01-31 January	Tunis ACC	New radar equipment implementation	-	8,258 minutes
15-January	Greece	Greek ATC Industrial action	-	507 minutes
02 February	Copenhagen ACC	FDPS failure	-	4,322 minutes
01 March	Bordeaux ACC	Technical issue with ESSO implementation	-	7,746 minutes
06 March	Brest ACC	CPR data outage	-	1,144 minutes
08 March	Italy	ATC industrial action	260 flights	Italian ACCs – 5,673 minutes Italian airports – 2,620 minutes
21/23 March	France	ATC industrial action	1,300 flights	French ACCs - 96,788 minutes French airports – 2,966 minutes Neighbouring States – 6,808 minutes
03 April	Network	NM ATFM and CCAMS Systems Outage	-	-
07/09 April	Marseille ACC	ATC industrial action	-	Marseille ACC – 107,424 minutes French ACCs – 4,182 minutes Neighbouring States – 10,370 minutes
08 April	Brest ACC	Radio failure	-	3,534 minutes
22 April	Prague ACC	FDPS failure	-	6,997 minutes
28 April	Bratislava ACC	FPDS failure	-	1,953 minutes
28 April	Lisbon ACC	FDPS failure	-	1,588 minutes
28/30 April	Marseille ACC	ATC industrial action	-	Marseille ACC – 68,552 minutes French ACCs – 11,450 minutes Neighbouring States – 6,935 minutes
05-07 May	Marseille ACC	ATC industrial action	-	Marseille ACC – 76,117 minutes French ACCs – 16,945 minutes Neighbouring States – 4,841 minutes
08 May	Italy	ATC industrial action	600 flights	Italian ACCs – 12,462 minutes Italian airports – 7,046 minutes Neighbouring States – 852 minutes
12-14 May	Marseille ACC	ATC industrial action	-	Marseille ACC - 96,158 minutes French ACCs – 33,046 minutes Neighbouring States – 7,018 minutes
19 May	Stockholm ACC	FDPS failure	-	8,855 minutes

[9] The main source for the event description is the remark field on the NM ATFM Regulation (ANM)

Date	Location	Event	Traffic Impact (Cancellations)	ATFM Delay Impact
21-23 May	France	ATC industrial action	1.400 flights	French ACCs – 215,021 minutes French airports – 5,304 minutes Neighbouring States – 60,253 minutes
26-28 May	Marseille ACC	ATC industrial action	-	Marseille ACC – 99,224 minutes French ACCs – 43,274 minutes Neighbouring States – 6,668 minutes
28 May	Brussels CANAC	Frequency issues	-	2,503 minutes
30 May	Greece	ATC industrial action	-	Greeks ACCs – 3,876 minutes Greeks airports – 376 minutes
08 June	Italy	ATC industrial action		Italian ACCs – 5,083 minutes Italian airports – 6,973 minutes
08 June	Reims ACC	Communication system failure	-	1,088 minutes
09 June	Marseille TMA	Surveillance system failure	-	1,252 minutes
09-11 June	Marseille ACC	ATC industrial action	-	Marseille ACC – 100,981 minutes French ACCs – 13,761 minutes Neighbouring States – 10,831 minutes
16-18 June	Marseille ACC	ATC industrial action	-	Marseille ACC – 94,297 minutes French ACCs – 33,153 minutes Neighbouring States – 15,371 minutes
23-25 June	Marseille ACC	ATC industrial action	-	Marseille ACC – 100,788 minutes French ACCs – 27,906 minutes Neighbouring States – 27,212 minutes
26 June	French ACCs	FDPS instability	-	69,402 minutes
30 June	Makedonia ACC	Communication system failure	-	2,533 minutes
01/31 July	Bordeaux ACC	Frequency issues	-	5,474 minutes
09 July	Brest ACC	Communication system failure	-	2,099 minutes
13/16 July	Marseille TMA	Power failure	-	9,658 minutes
19 July	Brussels CANAC	FDPS failure	149 flights	Brussels ACC - 7,442 minutes Brest, Paris and Reims ACCs – 7,819 minutes
08 August	Copenhagen ACC	Surveillance system failure	-	1,856 minutes
30 August	Karlsruhe and Vienna ACCs	Communication system failure between Karlsruhe and Vienna	-	3,363 minutes
05/06 September	Ankara ACC	ATC equipment	-	48,261 minutes
06 September	Maastricht UAC	ATC equipment	-	11,383 minutes
23 September	Maastricht UAC	VCS failure	-	1,232 minutes
26 September	Karlsruhe UAC	Communication system failure	-	1,620 minutes
28 September	Athens ACC	Frequency issues	-	1,285 minutes
28 September	Zurich ACC	Surveillance system failure	-	1,214 minutes
06 October	Zurich ACC	Surveillance system failure	-	4,244 minutes
18 October	Brussels CANAC	Communication system failure	-	1,319 minutes
26 October	Lisbon ACC	Communication system failure	-	4,654 minutes
26 October	Madrid ACC	Surveillance system failure	-	2,471 minutes
27 October	Lisbon ACC	Radar maintenance	-	1,841 minutes
28 October	Lisbon and Madrid ACCs	Communication system failure between Lisbon and Madrid	-	3,113 minutes
28 October	Lisbon ACC	Surveillance system failure	-	1,147 minutes
14 December	France	ATC industrial action	-	French ACCs – 45,385 minutes Neighbouring States – 4,836 minutes

Table 3: Unplanned Events/Disruptions

5.3 ACC ANALYSIS

In the European Network Operations Plan (NOP) 2018 – 2019/22[iv] there are two delay values for each ACC:

- The required en-route delay/flight performance to achieve annual network delay target in 2018 (0.5 min/flight). This is also known as the "delay breakdown", or reference values.
- The forecast delay based on 2018 NOP capacity planning, excluding disruptions such as industrial action and technical failures.

Table 4 shows the traffic growth, capacity and delay for each ACC. Those ACCs that exceeded their reference value are highlighted in "amber". The actual delay in 2018 was higher than the breakdown value reported in the NOP 2018-19/22 for 31 out of 65 ACCs.

COUNTRY	ACC	ACC Code	EN-ROUTE DELAY			TRAFFIC			CAPACITY	
			Breakdown[10]	Forecast[11]	Actual	Forecast (Low/High)[12]	Summer[13] Actual	Annual[14] Actual	NOP Plan	Actual
NETWORK	NETWORK	ALL_DNM	0,50	1,35	1,73		3.5%	3.8%		
ALBANIA	TIRANA ACC	LAAAACC	0.10	0.01	0.00	4.8%/ 8.0%	6.5%	6.1%	5%	3%
ARMENIA	YEREVAN ACC	UDDDACC	0.01	0.01	0.00	4.7%/ 7.5%	21.9%	24.8%	suff	suff
AUSTRIA	WIEN ACC	LOVVACC	0.19	0.32	0.90	3.5%/ 6.3%	7.0%	7.3%	4,0%	1%
AZERBAIJAN	BAKU ACC	UBBAACC	0,01	0,01	0,00	8.6%	5.1%	6.1%	suff	suff
BELGIUM	BRUSSELS ACC	EBBUACC	0.08	0.19	0.19	0.9%/ 3.4%	3.1%	3.3%	4%	3%
BOSNIA	SARAJEVO ACC	LQSBACC	0,01	0,01	0,00	6.2%	0.3%	-0.2%	suff	suff
BULGARIA	SOFIA ACC	LBSRACC	0.06	0.01	0.00	5.8%/ 9.0%	12.6%	11.7%	4%	7%
CROATIA	ZAGREB ACC	LDZOACC	0.24	0.25	0.65	3.0%/ 6.0%	10.9%	10.4%	1%	0%
CYPRUS	NICOSIA ACC	LCCCACC	0.25	1.02	1.10	8.0%/ 12.2%	8.9%	9.5%	5%	13%
CZECH REPUBLIC	PRAGUE ACC	LKAAACC	0.10	0.16	0.50	2.5%/ 5.2%	7.8%	7.4%	1%	-3%
DENMARK	COPENHAGEN ACC	EKDKACC	0.07	0.01	0.01	0.6%/ 2.6%	2.4%	2.7%	1%	1%
ESTONIA	TALLINN ACC	EETTACC	0.03	0.02	0.11	3.8%/ 6.3%	7.0%	7.4%	suff	suff
EUROCONTROL	MAASTRICHT UAC	EDYYUAC	0.17	1.23	0.79	1.6%/ 3.6%	0.3%	1.3%	2%	0%
FINLAND	TAMPERE ACC	EFESACC	0.09	0.01	0.00	5.0%/ 7.0%	9.3%	9.8%	suff	suff
FRANCE	BORDEAUX ACC	LFBBALL	0.13	0.33	0.27	2.5%/ 5.1%	1.2%	2.1%	8%	3%
FRANCE	REIMS ACC	LFEEACC	0.18	1.22	1.22	1.8%/	3.5%	3.3%	5%	-5%

[10] The required en-route delay/flight performance to achieve annual network delay target in 2017 (0.5 min/flight), also known as "delay breakdown" - NOP 2018- 2019/22
[11] Forecast delay based on 2018 capacity planning including disruptions such as industrial action and technical failures at a statistical level of 0.1 min/flt - NOP 2018-19/22
[12] Low/High traffic forecast STATFOR Feb 2018 used for NOP capacity planning, variation in % compared to 2017. When not available, Base forecast is provided.
[13] May to October (inc.)
[14] Growth calculated based on the average daily traffic for 2018 and 2017

COUNTRY	ACC	ACC Code	EN-ROUTE DELAY			TRAFFIC			CAPACITY	
			Breakdown[10]	Forecast[11]	Actual	Forecast (Low/High)[12]	Summer[13] Actual	Annual[14] Actual	NOP Plan	Actual
						3.9%				
FRANCE	PARIS ACC	LFFFALL	0.14	0.10	0.23	0.8%/ 2.8%	1.8%	1.2%	1%	2%
FRANCE	MARSEILLE ACC	LFMMACC	0.15	0.88	2.52	2.8%/ 5.6%	2.3%	3.8%	15%	-5%
FRANCE	BREST ACC	LFRRACC	0.10	0.50	0.94	1.2%/ 3.8%	1.8%	2.9%	14%	0%
REPUBLIC OF NORTH MACEDONIA	SKOPJE ACC	LWSSACC	0.21	0.04	0.18	3.7%/ 7.1%	13.3%	12.4%	5%	5%
GEORGIA	TBILISI ACC	UGGGACC	0,01	0,01	0,00	7.3%	5.1%	7.2%	suff	suff
GERMANY	LANGEN ACC	EDGGALL	0.23	0.31	0.49	1.7%/ 4.2%	4.7%	5.4%	1.2%	-2%
GERMANY	MUNCHEN ACC	EDMMACC	0.20	0.15	0.25	1.7%/ 4.2%	5.7%	5.5%	1.2%	2%
GERMANY	KARLSRUHE UAC	EDUUUAC	0.26	1.78	2.17	2.0%/ 4.6%	-2.1%	0.4%	-1%	-11%
GERMANY	BREMEN ACC	EDWWACC	0.06	0.05	0.17	-1.1%/ -3.2%	2.0%	3.0%	0%	0%
GREECE	ATHINAI ACC	LGGGACC	0.19	0.20	0.00	4.7%/ 7.5%	10.4%	9.1%	5%	4%
GREECE	MAKEDONIA ACC	LGMDACC	0.15	0.23	0.27	4.8%/ 8.0%	14.9%	14.4%	3%	5%
HUNGARY	BUDAPEST ACC	LHCCACC	0.04	0.07	0.41	4.2%/ 7.3%	11.6%	10.5%	3,0%	1%
IRELAND	DUBLIN ACC	EIDWACC	0.04	0.01	0.00	1.6%/ 4.4%	4.0%	3.4%	9%	3%
IRELAND	SHANNON ACC	EISNACC	0.04	0.01	0.00	0.6%/ 2.8%	3.1%	1.6%	2%	0%
ISRAEL[15]	TEL AVIV ACC	LLLLACC	*n/a*	*n/a*			10.7%	*15.7%*	*n/a*	
ITALY	BRINDISI ACC	LIBBACC	0.01	0.01	0.00	3.3%/ 6.3%	15.5%	14.7%	5%	11%
ITALY	MILAN ACC	LIMMACC	0.09	0.01	0.05	1.8%/ 4.5%	6.3%	6.1%	3%	2%
ITALY	PADOVA ACC	LIPPACC	0.10	0.01	0.00	2.0%/ 4.6%	4.7%	5.2%	2%	4%
ITALY	ROME ACC	LIRRACC	0.04	0.01	0.00	1.1%/ 3.8%	5.2%	5.8%	3%	6%
LATVIA	RIGA ACC	EVRRACC	0.03	0.01	0.04	4.4%/ 7.4%	9.2%	8.6%	suff	suff
LITHUANIA	VILNIUS ACC	EYVCACC	0.04	0.01	0.00	4.8%/ 8.0%	10.5%	9.8%	suff	suff
MALTA	MALTA ACC	LMMMACC	0.02	0.01	0.00	3.1%/ 6.9%	9.3%	8.2%	suff	suff
MOLDOVA	CHISINAU ACC	LUUUACC	0.01	0.01	0.00	3.1%/ 5.9%	10.8%	9.3%	suff	suff
MOROCCO[12]	CASABLANCA ACC	GMMMACC	*n/a*	*n/a*			3.7%	*4.9%*	*n/a*	
NETHERLANDS	AMSTERDAM ACC	EHAAACC	0.15	0.13	0.08	0.3%/ 1.6%	-0.3%	0.8%	1%	1%
NORWAY	BODO ACC	ENBDACC	0.10	0.01	0.00	0.4%/ 1.8%	-3.2%	-2.7%	suff	suff
NORWAY	OSLO ACC	ENOSACC	0.15	0.02	0.01	1.1%/ 3.6%	1.1%	1.8%	suff	2%
NORWAY	STAVANGER ACC	ENSVACC	0.10	0.02	0.00	0.9%/ 2.7%	0.4%	0.9%	suff	suff
POLAND	WARSAW ACC	EPWWACC	0.23	0.17	0.26	4.9%/ 8.2%	10.1%	5.0%	4%	10%
PORTUGAL	LISBON ACC	LPPCACC	0.12	0.12	0.20	3.1%/ 5.8%	2.8%	3.3%	3%	3%
ROMANIA	BUCHAREST ACC	LRBBACC	0.01	0.01	0.12	4.3%/ 7.5%	11.2%	9.8%	0%	0%

[15] Only actual data (not planned) is reported for Israel and Morocco. Both states are now part of IFPS but they are still on a transition phase towards full ATFCM integration. Therefore, their operational plans were not part of the NOP 2017– 2019/21 - their inclusion is envisaged for 2019.

COUNTRY	ACC	ACC Code	EN-ROUTE DELAY			TRAFFIC			CAPACITY	
			Breakdown[10]	Forecast[11]	Actual	Forecast (Low/High)[12]	Summer[13] Actual	Annual[14] Actual	NOP Plan	Actual
SERBIA / MONTENEGRO	BEOGRAD ACC	LYBAACC	0.10	0.08	0.30	3.9%/ 7.1%	10.1%	9.5%	1%	1%
SLOVAKIA	BRATISLAVA ACC	LZBBACC	0.11	0.06	0.22	4.2%/ 7.3%	11.7%	10.2%	1%	1%
SLOVENIA	LJUBLJANA ACC	LJLAACC	0.23	0.02	0.01	3.6%/ 6.5%	9.6%	8.7%	3%	7%
SPAIN	CANARIAS ACC	GCCCACC	0.27	0.33	0.53	2.4%/ 4.9%	8.4%	7.0%	1%	0%
SPAIN	BARCELONA ACC	LECBACC	0.22	0.43	0.78	4.1%/ 7.0%	3.6%	4.5%	5%	0%
SPAIN	MADRID ACC	LECMALL	0.14	0.11	0.25	3.7%/ 6.4%	4.7%	5.5%	2%	0%
SPAIN	PALMA ACC	LECPACC	0.18	0.25	0.15	0.7%/ 3.3%	3.4%	4.4%	2%	4%
SPAIN	SEVILLA ACC	LECSACC	0.13	0.11	0.16	4.0%/ 7.0%	4.0%	6.2%	2%	5%
SWEDEN	MALMO ACC	ESMMACC	0.06	0.03	0.03	2.0%/ 4.1%	5.3%	5.6%	1%	4%
SWEDEN	STOCKHOLM ACC	ESOSACC	0.07	0.02	0.04	0.6%/ 1.9%	-1.8%	-0.3%	1%	0%
SWITZERLAND	GENEVA ACC	LSAGACC	0.19	0.25	0.17	0.7%/ 3.2%	1.8%	2.3%	1%	1%
SWITZERLAND	ZURICH ACC	LSAZACC	0.18	0.29	0.36	1.1%/ 3.9%	6.9%	6.2%	2%	1%
TURKEY	ANKARA ACC	LTAAACC	0.15	0.01	0.03	5.5%/ 8.8%	8.4%	8.5%	20%	13%
UKRAINE	KYIV ACC	UKBVACC	0.02	0.01	0.00	6.2%/ 9.9%	12.8%	13.2%	suff	suff
UKRAINE	DNIPROPETROVSK ACC	UKDVACC	0.01	0.01	0.00	4.5%/ 8.3%	4.6%	7.1%	suff	suff
UKRAINE	L'VIV ACC	UKLVACC	0.01	0.01	0.00	7.3%/ 10.5%	26.6%	25.8%	suff	suff
UKRAINE	ODESA ACC	UKOVACC	0.01	0.01	0.00	6.5%/ 10.9%	15.3%	16.7%	suff	suff
UNITED KINGDOM	PRESTWICK ACC	EGPXALL	0.14	0.04	0.06	0.3%/ 2.3%	0.2%	0.06%	2%	1%
UNITED KINGDOM	LONDON ACC	EGTTACC	0.18	0.16	0.11	0.8%/ 2.7%	1.4%	1.6%	1%	0%
UNITED KINGDOM	LONDON TC	EGTTTC	0.10	0.10	0.31	0.7%/ 2.3%	0.5%	0.7%	2%	-5%

Table 4: Overview of the ACC performances in 2018

Compared to the delay forecast, the performance of the following ACCs performance was better than foreseen[16] in the NOP 2018-2019/22: Maastricht, Palma, Geneva, Bordeaux, Amsterdam and London ACCs.

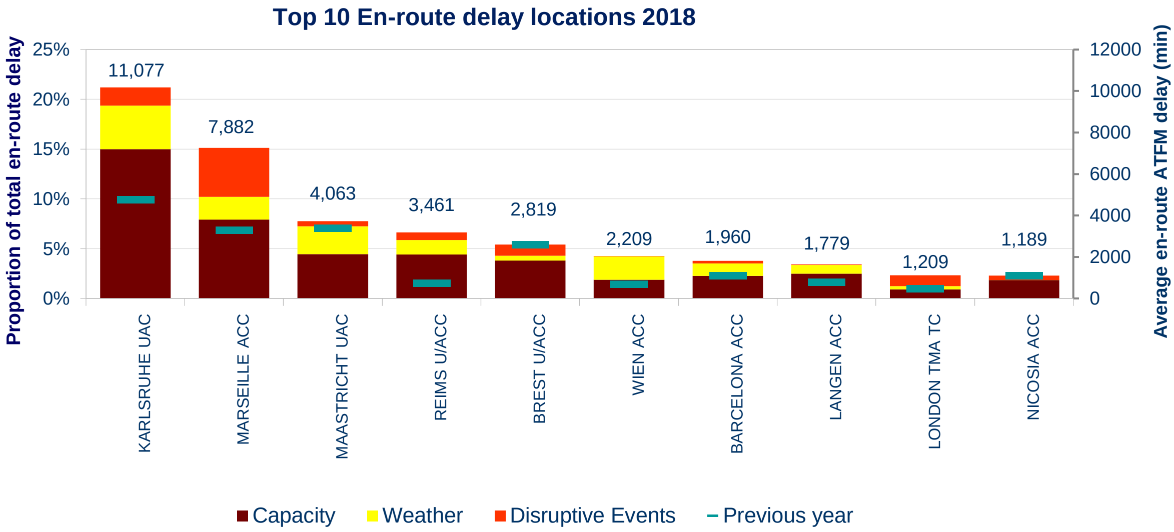
The performance of 27 ACCs was worse than foreseen[17] in the NOP 2018-2019/22 when compared to the delay forecast: Marseille, Reims, Vienna, Brest, Zagreb, Karlsruhe, Barcelona, Athens, Budapest, Prague, Beograd, London TC, Canarias, Langen, Bratislava, Madrid, Skopje, Paris, Bremen, Bucharest, Munich, Warsaw, Tallinn, Nicosia, Lisbon, Zurich and Sevilla ACCs.

[16] This means the actual delay was lower than forecast delay by at least 0,05
[17] This means the actual delay was higher than forecast delay by at least 0,05

5.3.1 DEMAND AND CAPACITY MONITORING

ATC capacity and staffing issues in a set of ACCs were the main cause of the en-route ATFM delays in the network (in addition to weather), particularly over the summer, and over the weekends. Karlsruhe and Marseille were the biggest generators of en-route ATFM delay.

Nevertheless, a number of ACCs which had been identified in the Network Operations Plan (NOP) as having capacity short-comings for the summer season have confirmed the proposed NOP measures and performed better than expected. These include Maastricht and Bordeaux ACCs.



The next paragraphs describe a more detailed view on the performance[18] of the most affected ACCs by capacity and staffing issues. Some of these ACCs have provided feedback on the analysis to the Network Director of Operations (NDOP)[19] and their views are published in Annex II – ACC.

5.3.1.1 MARSEILLE

Marseille ACC had 3.72 minutes per flight of summer en-route delay, an increase of 133% compared to 2017 and well above the planned NOP delay forecast (1.26min/flt summer 2018). Summer traffic increased by 2.3% (May to October), despite the significant off-load occurred during the days with industrial action. Annual traffic growth was 3.8%.

The ACC was heavily impacted by industrial action at the beginning of the summer. Nineteen strike days with severe ATFM impact, including one national strike, were recorded in the ACC. The industrial actions led to significant drops in the capacity offered by the ACC. Only 10 sectors an hour were open during the strike days (vs a maximum of 27 sectors in the same days with

[18] Traffic, delay and capacity figures refer to the months of May to October (incl.). Sector schemes are compared against the NOP ACC plans, when available. Average hourly delay figures include capacity and staffing delays only.
[19] NDOP 19/22 20.03.18 Item 6.2 Action Paper: Network Performance Winter 2018/2019

no strikes, later in the summer). The neighbouring ACCs were confronted with significant increase in demand due to these strikes, namely Reims.

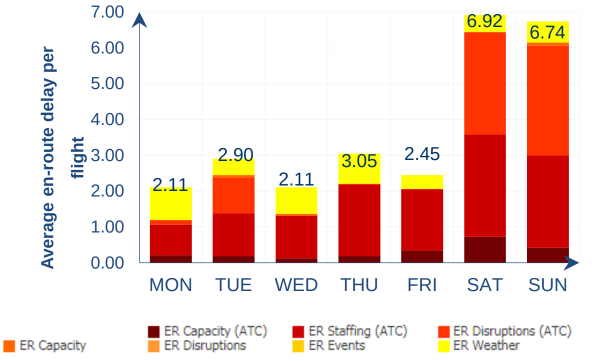


Figure 25 - Weekly En-route delay per flight - Marseille ACC Summer

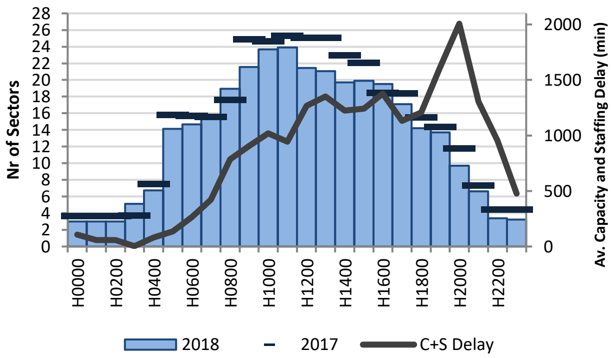


Figure 26 – Summer sector scheme - Marseille ACC Saturdays after 25/06 (vs. 2017)

From July onwards, normal operations in Marseille were affected by insufficient capacity with the ACC delivering fewer sectors compared to those opened in the previous year (Figure 25), which were already fewer than 2016. If in 2017, the eastern sectors concentrated most of the staffing issues, in 2018 the drop in sectors was extended to the western sectors, which opened 1 to 2 fewer sectors. The overall drop was especially noted from 12h onwards until the evening, with bigger impact on weekends. NM did not receive reliable sector opening plans for the NOP.

5.3.1.2 KARLSRUHE UAC

Karlsruhe UAC had 3.18 minutes per flight of en-route delay in the summer, the double of last year and above the planned NOP delay forecast (2.37 min/flt). The 4ACC initiative was successful in reducing the demand in Karlsruhe UAC. Summer traffic decreased by 2.1%, which helped to mitigate the staffing shortage at the UAC. However, aircraft flew at sub-optimal flight levels with a cost impact on operators.

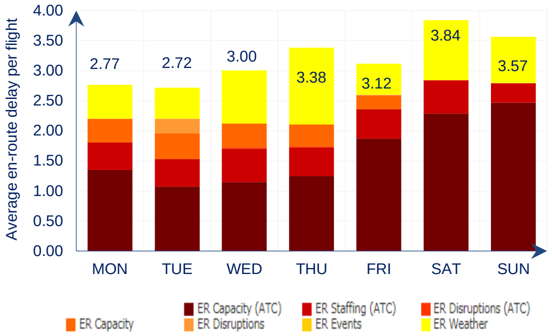


Figure 27 - Weekly En-route delay per flight – Karlsruhe UAC Summer

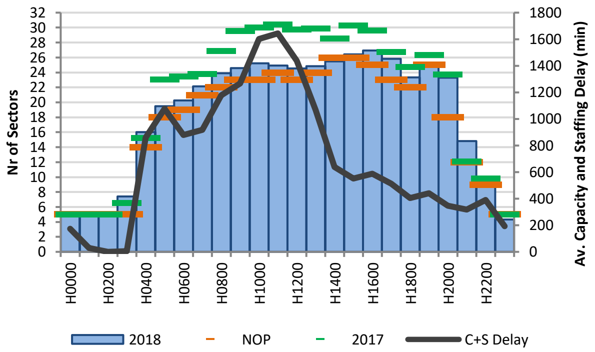


Figure 28 – Summer sector scheme (average) - Karlsruhe UAC Sunday (vs. NOP plan and 2017)

The announced staffing issues in the UAC were reflected in a significant drop in sector numbers compared to 2017 – 5 to 6 fewer sectors during core hours (Figure 28). The gap in sectors was less significant during first-rotation and late evenings. The number of open sectors was aligned with the plans declared in the NOP. As a result of the sector shortage, capacity and staffing delays were very high during every day of the week, with a daily peak at around 12h.

As in 2017, the share of regulations applied on elementary sectors (vs collapsed sectors) was only 25% compared to almost 50% in 2016 (the last year without staffing issues in Karlsruhe).

5.3.1.3 BREST

Brest had 1.36 minutes per flight of en-route delay in the summer, an increase of 30% compared to 2017 and above the NOP predicted delay (0.72 min/flt) - but still below 2016 levels. Summer traffic increased 1.8% - slower growth when compared to last year's 8%.

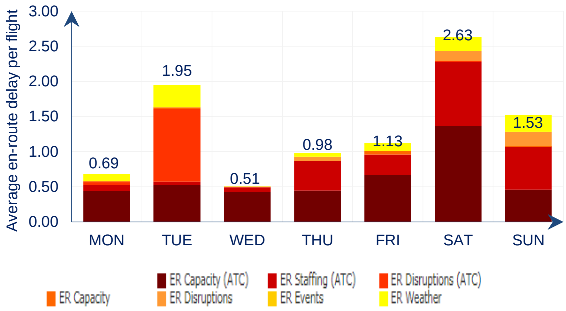


Figure 29 - Weekly En-route delay per flight – Brest ACC Summer

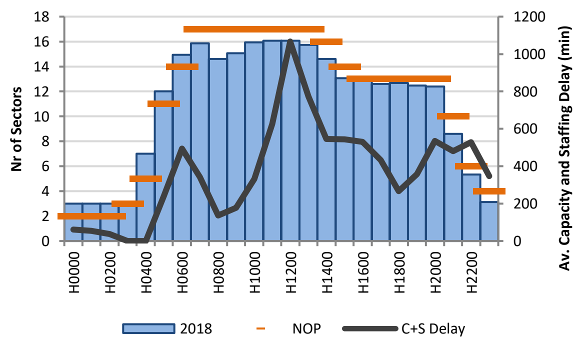


Figure 30 – Summer sector scheme (average) – Brest ACC Saturday (vs. NOP)

Capacity and staffing delays occurred every day of the week, and were especially high on Saturdays (Figure 29). Delay peaked at noon, evening and to a lesser extent, during the first-rotation hours. The latter period recorded an increase in sector numbers compared to the previous year (Figure 30). Nevertheless, the rest of the day had fewer sectors than 2017 and fewer than those declared in the NOP.

5.3.1.4 MAASTRICHT UAC

Maastricht UAC had 1.22 minutes per flight of en-route delay by the end September, an increase of 17% compared to 2017 but below the NOP summer forecast for the year (1.51 min/flt). Traffic remained at 2017 levels but evening traffic was higher, especially on the weekend.

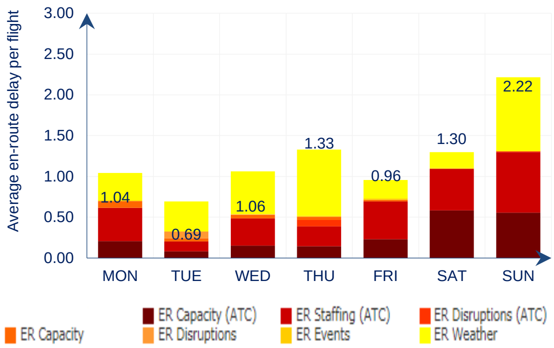


Figure 31 - Weekly En-route delay per flight – Maastricht UAC Summer

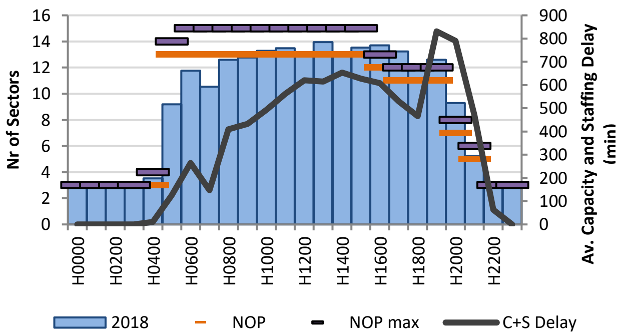


Figure 32 –Summer sector scheme (average) – Maastricht UAC Sunday (vs. NOP plan)

Capacity and staffing delays in the UAC were especially high on weekends, from Friday evening to Sunday (Figure 31). The periods from 12h to 16h on Saturdays and the evenings on Fridays and Sundays were the most critical periods in the UAC. Overall, the number of sectors open was lower or similar to 2017 (Figure 32). When comparing them with the planned sectors (min. and max.), they were closer to the lower figure. However, on certain periods (e.g. Sunday evening, pictured above) the UAC provided more capacity than initially planned. About 41% of ATFM regulations were applied on elementary sectors during the summer months (vs 61% in 2017).

5.3.1.5 REIMS

Reims ACC had 1.93 minutes per flight of en-route delay – 5 times more delay than 2017, and considerably more than the NOP summer forecast (0.47 min/flt). Traffic increased by 3.5%, partly driven by re-routed flights due to Marseille ACC strikes.

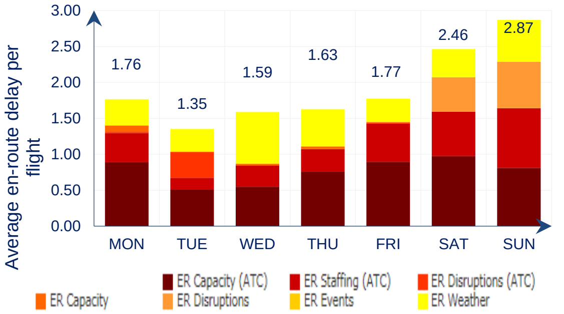


Figure 33 - Weekly En-route delay per flight – Reims ACC Summer

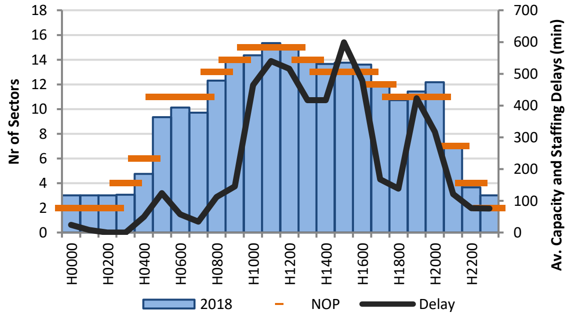


Figure 34 –Summer sector scheme (average) – Reims ACC Monday (vs. NOP plan)

Capacity and staffing delays were high from Friday to Monday (Figure 33). The ACC delivered more sectors than the previous year. The average sector schemes were below the NOP plans on certain periods but the same or above during the hours of peak demand (Figure 34). Nevertheless, considering the traffic increase, Reims FMP has indicated that the capacity offered was at least three sectors short during peak hours on weekends.

5.3.1.6 VIENNA

Vienna ACC had 1.46 minutes per flight of en-route delay in the summer, 3 times the figure of the previous summer and well above the NOP forecast (0.33 min/flt). Summer traffic recorded high growth - above 7%.

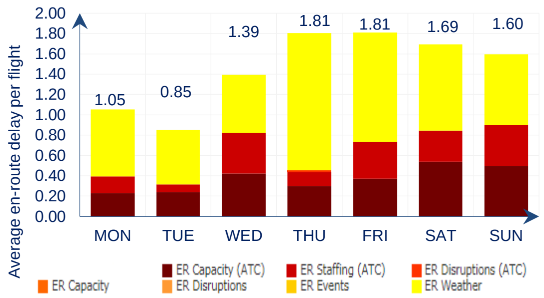


Figure 35 - Weekly En-route delay per flight – Vienna ACC Summer

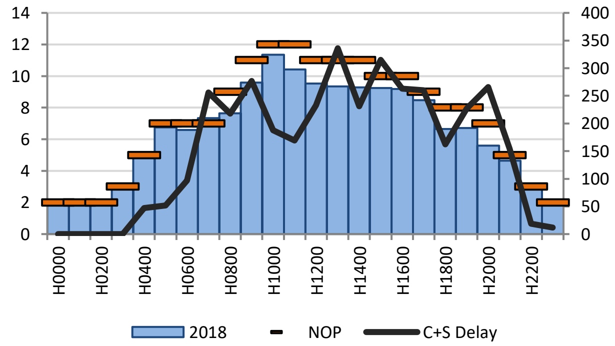


Figure 36 –Summer sector scheme (average) – Vienna ACC Wednesday (vs. NOP plan)

The capacity issues and the difficult weather situation (weather delay accounted for more than 60% of the ACC's delay) explain the worsening of the ACC performance. Capacity and staffing delays occurred mostly during weekends and on Wednesdays (Figure 35). Overall, average opening scheme was below 2017 figures and the NOP plan (Figure 36).

5.4 ATFM MEASURES

High traffic demand was forecasted for the whole network and severe capacity constraints were expected in core areas of the network. ACCs prepared mitigation plans, introducing RAD restrictions and ATFM scenarios to help manage the available capacity. The 4ACC initiative implemented a large set of measures aimed at diverting demand from the risk areas, namely away from Karlsruhe UAC.

Many of the ATFM scenarios created in 2017 became RAD restrictions in summer 2018, an outcome of the 4ACC initiative. There were over 8,500 ATFM scenarios applied in 2018 (Figure 37), a decrease of 26% compared to 2017. The decrease occurred in ACCs such as Maastricht, Reims and Karlsruhe.

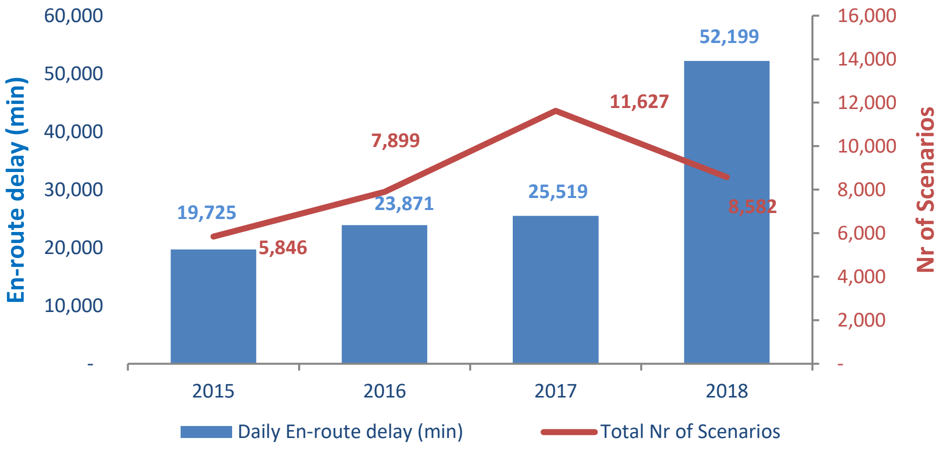


Figure 37 Network En-route delays vs Scenarios applied

Level-capping scenarios (FL) represented 54% of the total ATFM scenarios while rerouting (RR) accounted for 45% and Alternative routing scenarios (AR) 1%. Madrid, Paris and Brest have all applied more than 1,000 scenarios each.

5.5 TRAFFIC VOLATILITY

ACCs first highlighted the problem of traffic volatility during 2017[20] and the issue has continued in 2018. They observed a high number of ATFCM restrictions and fluctuations in tactical traffic counts that made it very difficult to manage operations (capacity provision).

Airports also reported departure sequence issues due to the amount of updates to take off times. Similarly, airline operations complained of increase workload due to frequent updates of CTOT. NMOC faced record number of helpdesk calls to resolve tactical problems.

Figure 38 shows the network-wide traffic volatility indicator. Time volatility is given by the variation of traffic volume (TV) counts for expected traffic due to estimated entry time changes. Airspace volatility is given by variation of TV counts due to flights that are either expected but do not show up (avoiders) or traffic not expected (i.e. not planned) but it is actually entering the TV (unanticipated traffic). The overall volatility indicator in 2018 was 5.1 flights at the start of the

[20] ODSG paper, Skyguide, 2017

entry-hour (blue line on the chart), representing the average amount of unexpected traffic on all regulated TVs of the network.

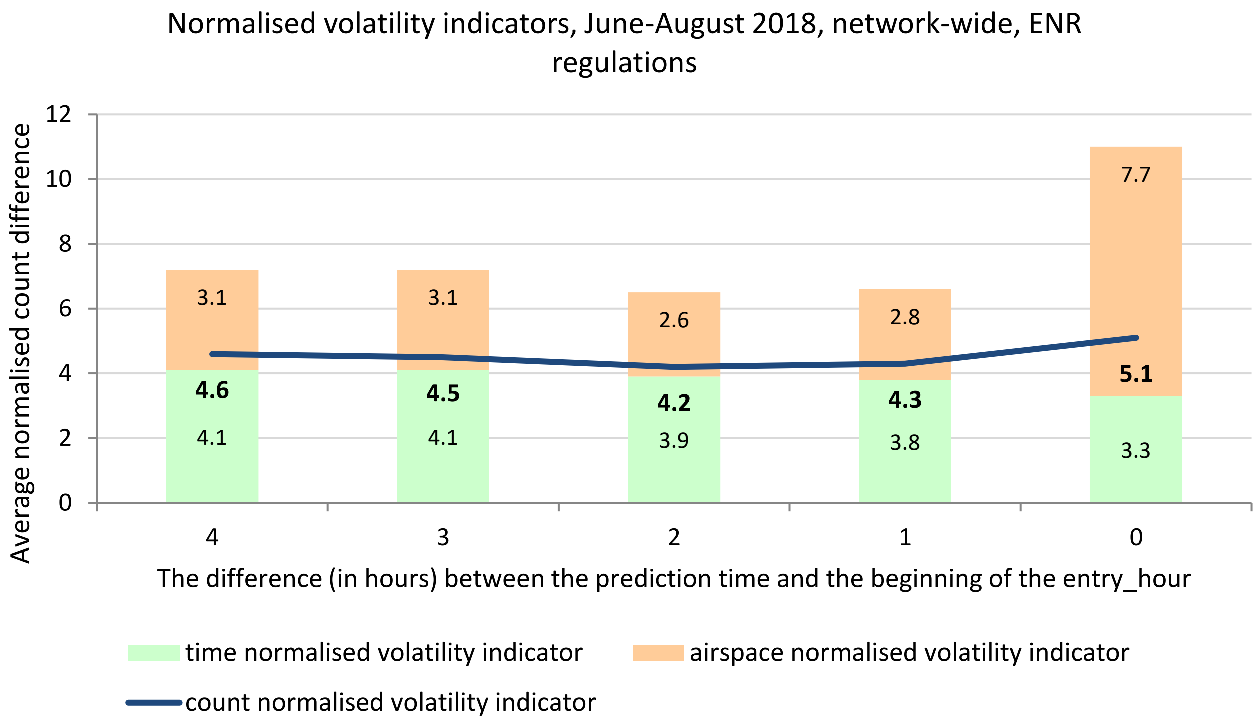


Figure 38 : Network En-route Volatility Indicators

Figure 39 lists the regulated airspaces that suffered the most from systemic unpredictability in 2018. FMPs in central Europe are among the most penalised by en-route volatility, namely Beograd, Zagreb, Hungary and Bratislava FMPs.

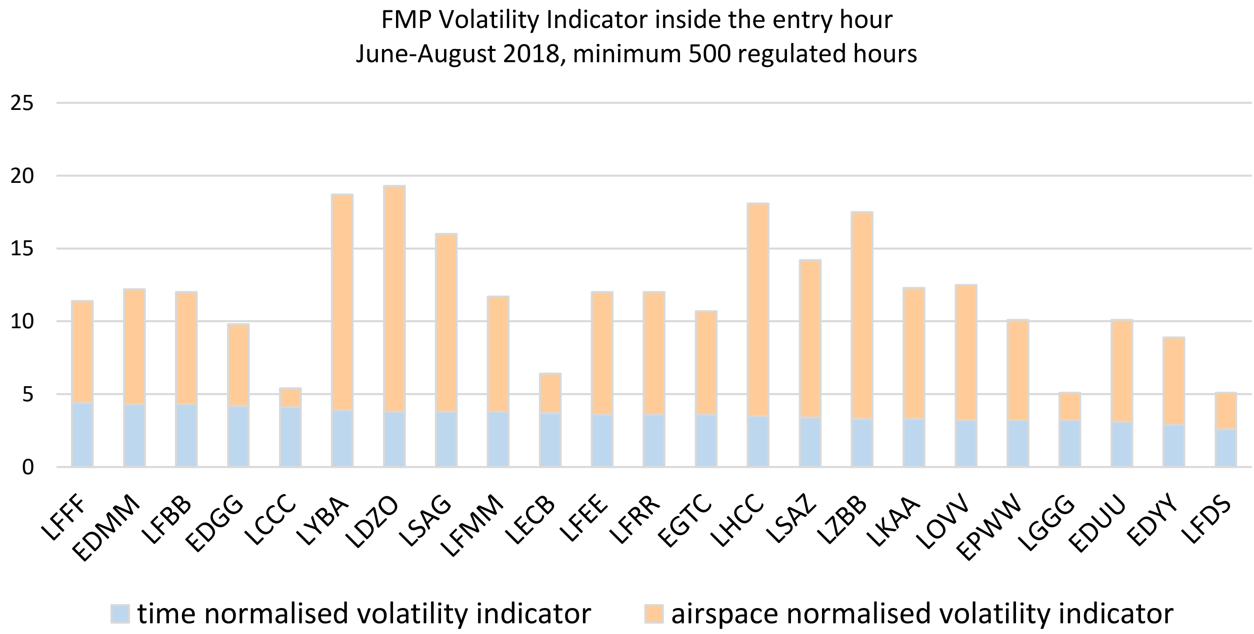


Figure 39 : Volatility indicator per FMP

At airport level frequent changes to CTOT explain why many airports find it difficult to maintain a stable departure sequence. Equally, flow management units experience load fluctuations that trigger further adjustments on the regulations. These regulations adjustments are at the origin of other updates that repeat the cycle of events repetition. Figure 40 shows the number of CTOT updates and corresponding reasons before ATOT in summer 2018.

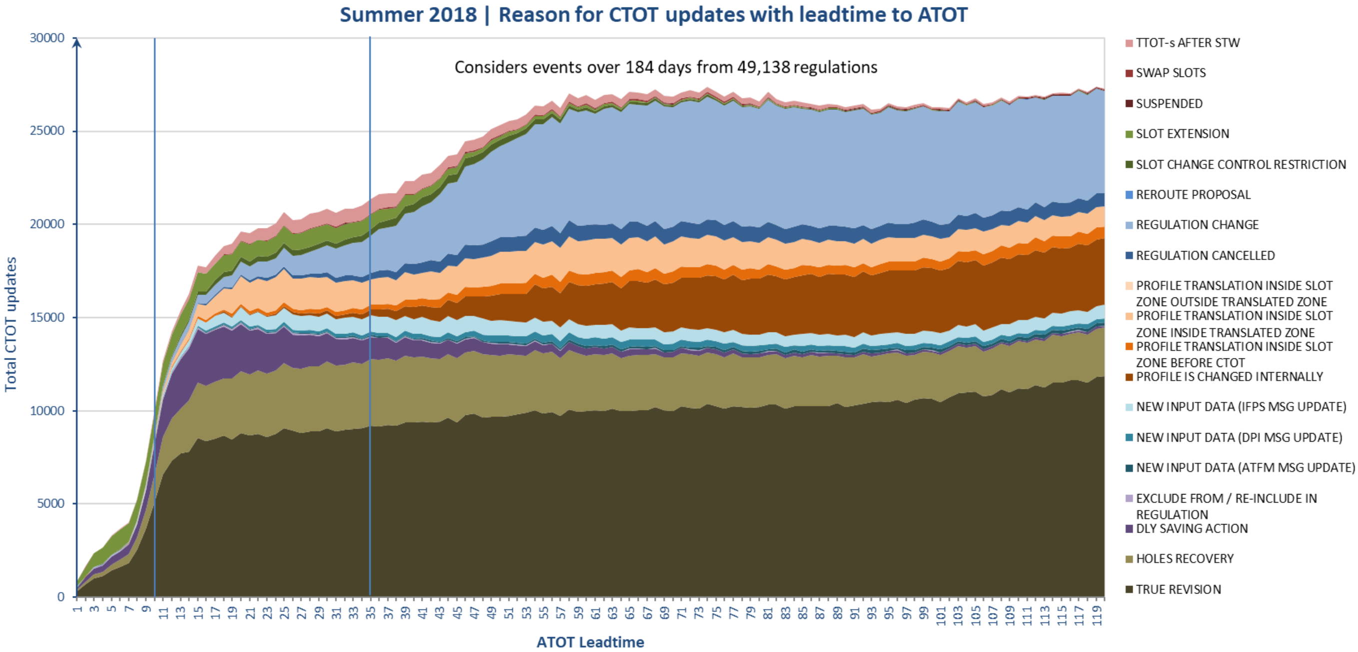


Figure 40 Reasons for CTOT updates in Summer 2018

At around 30 minutes or before CTOT (period to the right of the second blue line in Figure 40), most updates are due to changes on the regulation parameters and the true revision process. Within 30 minutes (period between the two vertical lines), DPI updates – essentially OBT updates – also came into play.

6 AIRPORTS

Departures from airports in the network increased by 3.4% in 2018 (see 4.4 Airport Traffic Evolution), while airport ATFM delays remained stable at a daily average of 18,013 minutes. Airport capacity and weather contributed with 79.7% of the total airport delays.

The integration of airports into the network advanced in 2018. There was progress towards the wider A-CDM implementation in Europe: two additional airports fully implemented A-CDM, making it a total of 28 A-CDM airports and covering 34% of the departures in the NM area In addition, 4 airports were connected to NM as Advanced ATC Tower airports, making 23 airports in total, covering close to 10% of departures in the NM area. NM now receives Departure Planning Information (DPI) messages from almost 44% of departures in the NM area.

The summer 2018 was once again challenging for Greek airports. Due to the long-standing nature of the problems at the Greek island airports, NM activated the airport function within the NMOC, which provided tactical support to the hot-spots.

There was very good collaboration from airports on the provision of strategic information to NM via the Airport Corner. This year the NM Airport Unit worked to enhance the quality of strategic airports information, as well as, to expand the number of contributing airports.

The Enhanced Information Exchange (EIE) process in which airports share data with NMOC has continued and evolved throughout the year. In this process, airports report expected capacity impacts caused by weather or other events during the ATFM pre-tactical phase of operations. In 2018, the implementation of the tactical diversion capabilities information provision and the introduction of an emergency reporting process have been the two major developments of the EIE process.

As of 2018, airlines can benefit from the airport information found in the dedicated and newly implemented Airport Corner for Airlines. A variety of specifically tailored airline services are available and expected to add value to the strategic and pre-tactical airline operations planning.

Runway throughput enhancement remains a topic of high importance for addressing current and future airport capacity needs, decreasing the TMA holding time and increasing the operational resilience. The Airport Unit of NM delivered the final report of the Athens International Airport Capacity Assessment mid-2018 to the Greek Authorities. ANA Luxemburg requested an Airport Capacity Assessment in 2018 and a real-time data collection took place at the end of 2018 at Luxemburg airport. On request of Skeyes, the Airport Unit worked in the Airport Capacity Assessment at Brussels airport. Data Collection took place through the available systems at Skeyes.

Since March 2018, RECAT-EU separation minima are fully operated for arrivals and departures at London Heathrow, enhancing Time-based Separation (TBS) - a world first -, allowing for 24 additional movements per day. RECAT-EU separation minima are now deployed at four European airports (Paris/Charles de Gaulle, Leipzig/Halle, London/Heathrow and Toulouse/Blagnac), with Vienna expected to follow in early 2019.

Time-Based Separation at London/Heathrow, operated since 2015, brought significant increase of operational resilience, in particular with a reduction of 62% in wind-related ATFM delays, 44 additional movements per day in strong winds and 13 extra movements per day across all wind. This results in circa 115,000 minutes per annum reduction in average airborne holding and no more tactical flight cancellations due to headwinds.

Time-Based Separation is now under development at Vienna airport, and a deployment project has been launched at Paris/Charles de Gaulle. In both cases, a procedural application will first be operated as a quick win, on the way to full TBS system implementation, in compliance with the Pilot Common Projects (PCP) regulation.

The First Rotation Optimisation Trial (FROT) at Zurich contributed to a positive network impact with fewer ATFM arrival delays (aerodrome capacity) and improved airport arrival slot compliance. Swiss International Air Lines' efforts to keep flight plans up-to-date improved the arrival demand picture at Zurich airport during the trial. The trial is due to end in March 2019.

On request of ACI EUROPE, NM has taken the lead in three projects for AOP-NOP connection under the Central European Facilities (CEF) calls 2015, 2016, 2017, all of which were successfully awarded. However, it was identified that the concepts required further validation and development for operational maturity, which is leading to some delay. NM has established working arrangements for filling the gaps but also faced budget and resource constraints that contribute to the delay.

NM continued the close and effective collaboration with airports through a number of bilateral meetings, visits and exchanges.

6.1 HOT SPOTS

The highest airport ATFM delay generators in 2018 were Amsterdam/Schiphol, Barcelona and Lisbon airports. Figure 41 shows the top 20 airports with highest airport ATFM delay in the network.

Amsterdam/Schiphol remained at the same levels of traffic as last year (0.7% increase) while its ATFM delay decreased by 30.5%. Schiphol's ATFM delay per flight also decreased by 30.9%. Airport weather was the main contributor (999 min/day, -25.2%) followed by airport capacity (624 min/day, -29.3%). Weather particularly impacted airport operations at Amsterdam/Schiphol in January, February and December.

Barcelona/El Prat traffic increased by 3.8% and delays increased from a daily average of 771 minutes in 2017 to 1,351 minutes in 2018 (75.2%). The average delay per flight also increased from 0.78 minutes per flight in 2017 to 1.47 minutes per flight in 2018 (88.5%). Airport capacity (part of it due to work in progress), environmental constraints and adverse weather conditions generated most of these delays. Airport weather delay increased from a daily average of 359 minutes in 2017 to 715 minutes in 2018, particularly affecting airport operations in May, August, September and October.

Lisbon airport recorded the highest increase in average daily ATFM delay (28.9%) and average delay per flight (271%), which nearly trebled. The main delay contributors were airport capacity (971 min/day, 415%) followed by airport weather (326 min/day, 39.3%), while traffic increased by 7.2%.

London/Heathrow traffic remained at the same level as in 2017. The airport's average daily ATFM delay decreased by 3.7% in 2018, of which 75.7% was due to weather. Adverse weather particularly affected airport operations in the winter season.

Istanbul/Ataturk airport traffic remained almost at the same level as in 2017, while ATFM delay decreased by 21.1%. Airport capacity was the main contributor (793 min/day, -21.2%), followed by weather (310 min/day, -31.7%).

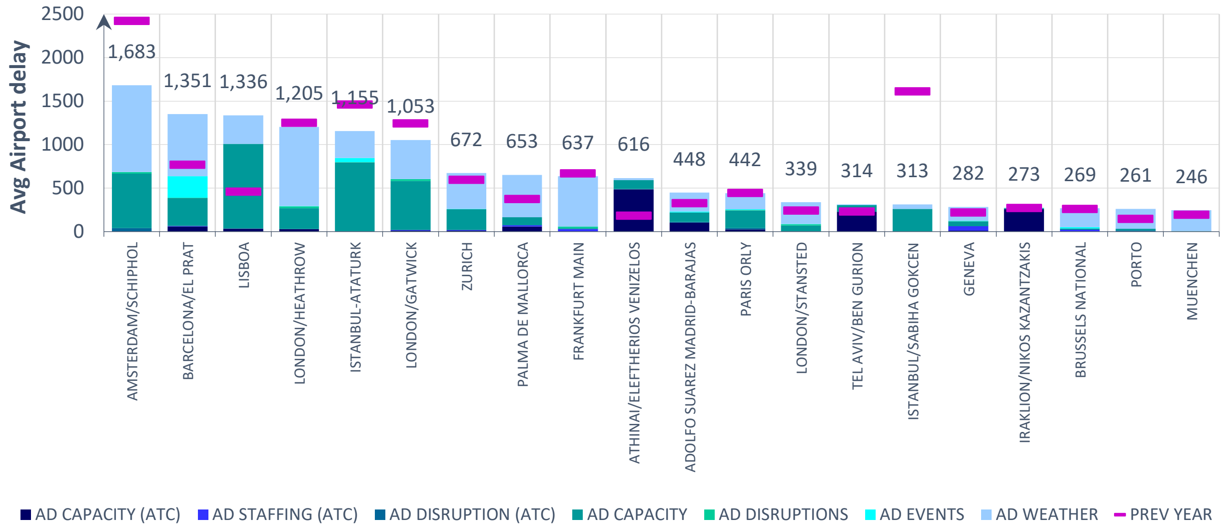


Figure 41: Top 20 airport delay locations during 2018[21]

London/Gatwick traffic remained at the same level as in 2017. ATFM delay decreased by 15.5% and delay per flight also decreased by 14.9% in 2018. Airport capacity and adverse weather were the main delay causes in 2018. Airport weather delay decreased from a daily average of 596 minutes in 2017 to 450 minutes in 2018, particularly impacting airport operations in April, May, October and November.

Zurich airport traffic increased by 3.1% compared to 2017, while ATFM delay and delay per flight both increased by 12.8% and 8.4% respectively. Airport capacity, weather and limited availability of the optimum runway configuration due to environmental constraints were the main delay causes. Airport capacity delay decreased to a daily average of 236 minutes (-6%) in 2018.

Palma de Mallorca traffic increased by 5.6% and ATFM delay increased by 74.1%. Airport weather was the main delay cause in 2018 at this airport. Airport weather delay increased from a daily average of 206 minutes in 2017 to 485 minutes in 2018, particularly impacting airport operations in October. Airport capacity delays decreased further (17%) to an average of 93 minutes per day.

Frankfurt/Main airport traffic increased by 7.7% and ATFM delay decreased by 4.8%. Adverse weather conditions caused most of the delays impacting airport operations particularly between May and August.

Athens airport traffic recorded a significant increase (11.3%) compared to 2017. Average daily ATFM delays increased more than threefold from 183 minutes in 2017 to 616 minutes in 2018. The main delay reason in 2018 was airport capacity (ATC), comprising 79% of all ATFM delay at Athens airport, while airport capacity contributed with 17% of the remaining delay.

Madrid/Barajas traffic increased by 5.7% and ATFM delay increased by 37%. This increase in ATFM delay is due to airport capacity (ATC) which now contributes 23.2% of the delay. Adverse

[21] Only airports with more than 11,000 movements/year are included

weather conditions and airport capacity delay have remained stable contributing 48.2% and 25% of the delay, respectively.

Paris/Orly traffic and delays have remained stable compared to 2017. A small decrease was recorded in daily delay from an average of 445 minutes in 2017 to 442 minutes in 2018. All works combined generated 75% of airport capacity delays and 42% of the airport's total delays.

London/Stansted traffic increased by 6.2% while ATFM delay increased by 39.5%. Average delay per flight also increased significantly by 31.4%. Delay related to adverse weather conditions increased by 39.4%. It was the main contributor to Stansted airport's delay and severely impacted operations from January through to May, October and November.

Tel Aviv/Ben Gurion airport traffic increased by 13.2% compared to 2017, while delay increased by 34.8%. Aerodrome capacity (ATC) increased by 63.3% and is the main delay cause (72.3% of all delay), followed by Airport capacity contributing 24.5% of delays.

Traffic increased by 5.5% in Istanbul/Sabiha Gökcen airport. ATFM delays decreased by 80.6%, after the drop already observed in 2017. Airport capacity was the main contributor for the decrease in delay, from 1,436 minutes per day in 2017 to only 262 minutes per day in 2018. In addition to this weather related delay also decreased by 71.4%, to an average of 50 minutes per day.

Geneva airport recorded a traffic decrease of 2% and an increase in ATFM delay of 27.6%. The increase in delay was mainly due to adverse weather conditions (22.8%), airport capacity (33.3%) and airport capacity (ATC) (15.2%).

Iraklion airport traffic increased by 10.1% while delay remained stable at an average of 274 minutes per day. Close to 95% of the delay is due to airport capacity (ATC).

Brussels airport traffic slightly decreased by 1.3% compared to 2017, while ATFM delay increased by 3.5%. Adverse weather conditions were the main delay cause in 2018.

Porto airport traffic increased by 7.9% while ATFM delay increased by 78.8% from a daily average of 146 minutes in 2017 to a daily average of 261 minutes in 2018. This increase in delay was driven by adverse weather conditions (94.9%).

Munich airport recorded a traffic increase of 2.2% and an ATFM delay increase of 26.2%. The increase in ATFM delay was driven by the increase in adverse weather related delay (23.7%).

Vienna, Oslo/Gardermoen, Paris/Charles de Gaulle and Paris/Le Bourget delays decreased compared to 2017 and the airports are no longer on the top 20 daily airport ATFM delay locations. Athens, Geneva, Porto and Munich are the new entrants this year.

Figure 42 shows the airports with the highest ATFM delay per flight in the network.

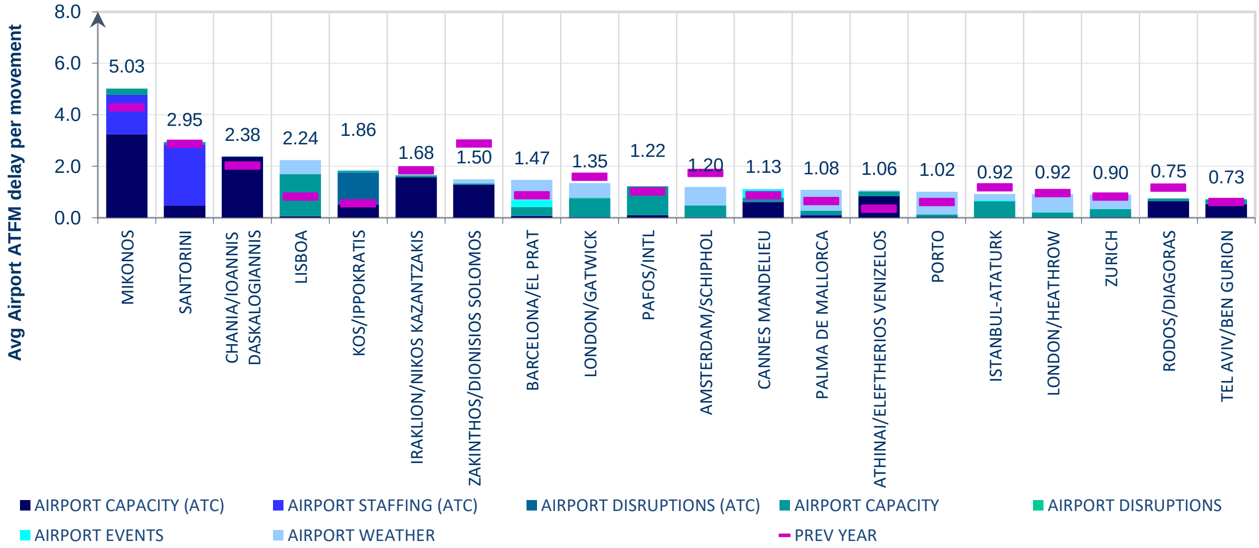


Figure 42: Top 20 airport delay per flight locations during 2018[1]

Greek airports had a traffic growth of 9.5% during 2018 (10.4% during the summer - April to October), while ATFM delay increased by 40%. Airport capacity (ATC) was the main delay cause for Greek airports. Mykonos, Santorini, Chania, Kos and Athens delays per flight increased, while Iraklion, Zakinthos and Rodos delays per flight decreased compared to 2017. Mykonos (17.3%) and Santorini (20%) traffic levels increased significantly, while Chania traffic slightly decreased (-3.1%), compared to 2017. See 6.3.1 for more details on the Greek islands summer performance.

Paphos airport delay per flight increased by 18.5%, from 1.03 minutes per flight in 2017 to 1.22 minutes per flight in 2018. Airport capacity related delay increased by 8.7% and is still the main delay reason. However, it is not the only delay cause anymore with airport capacity (ATC) contributing with 9% of all ATFM delay.

Cannes/Mandelieu airport delay per flight increased by 28.4% compared to 2017. Though the main delay cause for 2017, airport capacity (ATC) reduced by 31.8%, the overall delay increase was driven by airport events (340%) and the appearance of airport capacity delay.

Palma de Mallorca traffic increased by 5.6% and delay per flight increased from 0.66 minutes in 2017 to 1.08 minutes in 2018 (63.6%). The increase in delay has mainly been driven by the adverse weather delay (225%).

Istanbul/Sabiha Gökcen, Paris/Le Bourget, London/City and Paris/Orly delays per flight decreased and are no longer in the top 20 delay per flight locations. Kos, Athens, Porto and Tel Aviv/Ben Gurion are the new entrants in the top 20 this year.

6.2 AIRPORT DISRUPTIONS

A number of unplanned disruptions[22] (Table 5) imposed capacity reductions at certain airports. Events that also had an impact at en-route level are listed in 5.2.2 En-route Disruptions.

Date	Location	Event	Traffic Impact	ATFM Delay Impact (minutes)
01-Jan to 20 Feb	Tunis/Carthage	New Radar Equipment installation	4,144 flights	13,628
02-Jan	Frankfurt/Main	Issues with local flight information system	297 flights	6,276
09-Jan	Cologne	Hole on taxiway	20 flights	1,198
21-Jan	Nantes/Atlantique	Hole on taxiway	40 flights	1,066
15-Feb	Paris/Charles de Gaulle	ILS partial unavailability in conjunction with low visibility procedures	91 flights	1,492
28-Feb	Amsterdam/Schiphol	Technical issues with local flight planning system	115 flights	2,361
02-Mar	Bologna	Lack of de-icing fluid	24 flights	1,051
10-Mar	Lanzarote	VOR-DME calibration in conjunction with TMA delay	unknown	1,123
14-Mar, 15-Mar and 18-Mar	Lanzarote	Apron works	78 flights	1,406
05-Apr	London/Stansted	Emergency repairs on runway	69 flights	1,992
29-Apr	Amsterdam/Schiphol	Power failure	227 flights	6,917
09, 10-May, 13-Jun and 07,19,20-Dec	Porto	ILS Flight check	169 flights	4,833
03-Jun	Hamburg	Power issues	11 flights	1,212
27-Jun	Geneva	Disabled aircraft on runway	41 flights	1,188
02-Jul to 21-Jul	Malaga	Works on manoeuvring area	228 flights	1,478
03-Jul to 06-Jul	Toulouse	Works on manoeuvring area	126 flights	1,447
06-Jul	London/Gatwick	Aircraft incident	265 flights	3,067
18-Jul	London/Heathrow	Evacuation of ATC tower facility	99 flights	2,801
28-Jul	Munich	Terminal evacuation due to security issues	44 flights	1,784
29-Jul and 30-Jul	Rodos/Diagoras	Check-in issues	65 flights	2,333
14-Aug	Barcelona	Non-availability of runway due to disabled aircraft	70 flights	1012
15-Aug	Amsterdam/Schiphol	Instability of communications	91 flights	2,047
27-Aug and 28-Aug	Amsterdam/Schiphol	Unavailability of tower back-up communications systems	531 flights	11,073
31-Aug	London/Gatwick	Runway inspection for foreign object debris, following the emergency landing of an A330	275 flights	4,657

[22] The main source for the event description is the remark field on the NM ATFM Regulation (ANM). Only events with an impact of more than 1.000 minutes of ATFM delay were considered in Table 5.

Date	Location	Event	Traffic Impact	ATFM Delay Impact (minutes)
03-Sep, 04-Sep, 26-Sep and 27-Sep	Brussels	Runway and taxiway works	151 flights	1,490
04-Sep to 30-Sep	Barcelona	Works on runway 25L-07R (in conjunction with environmental reasons)	948 flights	13,892
12,13 and 15-Sept	Cannes/Mandelieu	Yachting Festival	63 flights	1,846
22-Sep	Berlin/Tegel	Power outage of baggage handling system and shortage of ground handling personnel	148 flights	1,232
23-Sep to 28-Oct	Kos	VOR/DME unserviceable	703 flights	22,619
25-Sep and 26-Sep	Pisa/San Giusto	Forest fire in the vicinity of the airport	45 flights	1,799
25-Sep, 03-Oct, 04-Oct and 23-Oct	Barcelona	ILS calibration	395 flights	3,353
15-Oct to 24-Oct	Paris/Le Bourget	ILS calibration at LFPG impacting LFPB	143 flights	4,754
28-Oct	Lisbon	Radar failure	14 flights	1,147
07-Nov	London/Heathrow	Lighting control unstable	365 flights	2,237
11-Nov	Athens	ILS calibration	114 flights	1,319
21-Nov	Warsaw/Chopin	Runway 11-29 maintenance	469 flights	1,861
24-Nov	Dublin	Technical issues with radar equipment	45 flights	1,404
2-Dec to 10-Dec	Stockholm	Unreliable ground radar (A-SMGCS)	720 flights	11,694
07-Dec, 19 and 20-Dec	Porto	ILS flight check	68 flights	2,096
18 to 26-Dec	Nantes/Atlantique	Radar failure	389 flights	3,955
19-Dec to 20-Dec	London/Gatwick	Unauthorized drones in the vicinity	321 flights	7,554
24-Dec to 26-Dec	Catania/Fontanarossa	Mt. Etna volcanic eruption	67 flights	1,670

Table 5 Airport Disruptions 2018

6.3 NETWORK OPERATIONS SUPPORT

6.3.1 GREEK ISLANDS – SUMMER

Summer[23] traffic to Greek destinations increased by 10.4% in 2018. The majority of the smaller airports were once again operating at the limit of their declared capacity during periods of peak demand. At the same time, regulations applied at Athens airport created an adverse knock-on effect on those airports. Arrival delays over the summer period increased by 35.9%, with an increase from 439,520 minutes to 597,488 minutes in 2018. Despite the delay increase in 2018, the overall performance has improved since 2012 when the joint NM / Hellenic Civil Aviation Authority (HCAA) Action Plan was put in place.

In line with the previous years, operations during Summer 2018 were extremely challenging.

[23] From April to October – the months with highest traffic demand at those airports.

The long-standing capacity constraints at Greek island airports are related to airport layout, terminal buildings capacity, and, insufficient number of staff and lack of radar at some airports, which in consequence, requires the provision of non-radar approach ATC.

The mentioned ATC problems (insufficient number of staff and lack of radar at some airports) are unlikely to be resolved in 2019 and improvement is expected from 2020 onwards as new ATCOs are under training. In addition, with the privatisation of the airports, significant airport infrastructure projects have commenced in winter 2018 and will continue for the coming years.

The cooperation and joint efforts of the NMOC, the Hellenic Air Navigation Service Provider (HANSP) and the Hellenic Slot Coordination Authority (HSCA) has provided a major contribution to reduce delay levels that would have been much worse without it. In 2018 full monitoring of Airport Slot Adherence on GA/BA traffic was conducted on the request of the HCAA. Daily coordination between the HSCA and NM saw Flight Suspension messages sent to over 100 flights during the summer period.

6.4 AIRPORT CDM IMPLEMENTATION AND ADVANCED ATC TOWER IMPLEMENTATION

In 2018, 2 airports became fully implemented CDM airports: Naples on 27 March and Amsterdam on 16 May. This brings the total number of fully implemented airports to 28. However, currently only 26[24] of these airports are sending DPI messages covering 34% of departures in the NM area.

More and more airports are implementing A-CDM bringing benefits not only to themselves but also to neighbouring ACCs (see the Network Impact Assessment study of A-CDM)[v]. The Amsterdam implementation means almost of Europe's main hub airports are now connected to the NMOC.

Airports that have no plans to implement the A-CDM process but still wish to integrate with the ATM network may do so as an Advanced ATC Tower airport. A number of airports are also considering this option as a first step towards full A-CDM implementation. Such airports provide a reduced set of DPI messages with a reduced set of advantages (compared to A-CDM airports). An Advanced ATC Tower airport provides Target Take-Off-Time (TTOT) estimations as well as Variable Taxi-Times (VTTs) and SIDs in use to the NMOC. These are provided from the moment the aircraft leaves the blocks.

In 2018, 4 airports connected to the Network as Advanced ATC Tower airports: Ibiza, Menorca, Lanzarote and Fuerteventura. This brings the total number of Advanced ATC Tower airports to 23, representing close to 10% of departures in the NM area.

The 26 A-CDM airports together with the 23 Advanced ATC Tower airports means that NM now receives Departure Planning Information (DPI) messages for 44% of departures in the NM area. Once London Gatwick and Stockholm Arlanda re-connect to the network, the provision of DPI messages will reach 47%.

Information on individual airports which implemented A-CDM and Advanced ATC Tower in 2018 can be found in Annex III.

[24] At London Gatwick and Stockholm Arlanda airports the A-CDM procedures and consequent DPI message transmission were temporarily suspended in 2018. Work is currently ongoing at both airports to have them once again fully connected with NMOC in 2019.

6.5 INFORMATION EXCHANGE BETWEEN AIRPORTS AND NM – AIRPORT CORNER PROCESS

As defined under the Network Functions Implementing Regulation (677/2011) – Annex V - Appendix II - Airports, the Network Manager has a task to assist airports to take the "network approach" in solving operational issues and enhancing performance.

The NM/Airport Unit has implemented a reporting process to capture relevant airport information and monitor airport operations and planning. This process is supported by a secured web based tool, the Airport Corner, which enables quick and easy information provision from airport stakeholders. It facilitates collaboration between local ANSPs and Airport Operators resulting in the provision of a coordinated airport view. Around 100 airports are contributing to the process.

The Enhanced Information Exchange (EIE) reporting process is established via the pre-tactical/tactical section of the Airport Corner. In 2018, 23 airports reported 103 pre-tactical events via the Airport Corner.

The two major developments to the EIE process during the year were:

- **The airport diversion capabilities** - a process in which, during a diversion situation, the NMOC experts may request the airports to provide diversion capabilities tactically via the Airport Corner. Airports can also proactively report such information if they want to inform the network (e.g. airport not available for diversions). This information facilitates airlines' planning in case of a diversion or major crises situations. It also replaces a significant portion of time-consuming telephone communications and facilitates diversion coordination between NM, airlines and airports.

  Since summer 2018, the NM requested airports to provide their tactical diversion capabilities on 12 occasions. There were 16 airports involved and an average response rate of 80% was achieved.

  The Diversion Capability module was also used successfully as part of the VOLCEX 18 crisis exercise with 7 airports (Athens, Barcelona, Geneva, Helsinki, Madrid, Vienna and Zurich).

  The NMOC Operations Managers endorse the airport Diversion Capabilities process and stress the need for more airports to actively contribute to it. This would further increase the situational awareness of aircraft operators and ATM stakeholders of the network.

- **The airport emergencies** is a process allowing airports to directly inform the NMOC and the network in case of an emergency. The main benefit is that this reporting reaches a wider audience compared to the point-to-point telephone communication and enhances the situational awareness through provision of contextual information on the emergency. The NM Airport Unit will keep airports informed about this process with regular awareness campaigns.

As of 2018, in addition to airports, airlines can also subscribe to receive EIE information via the new dedicated Airport Corner for Airlines interface.

The process of providing detailed post-ops feedback for airport events which had significant Network impact, was enhanced in 2018 and was shared with 30 airlines.Table 6 presents a list of airport planned events that were reported via the Airport Corner and had an ATFM impact.

ICAO Code	Airport Name	Event Name[25]	Start Date	End Date	ATFM Delay (minutes)
LGTS	Thessaloniki/ Makedonia	Rehabilitation work of runway 10/28	22-11-2017	05-02-2018	3,760
LFPO	Paris/Orly	Tower renovation in conjunction with taxiway maintenance	14-11-2017	04-04-2018	20,159
EDDH	Hamburg	Phase 5 of Apron 1 reconstruction	02-02-2018	18-06-2018	13,665
LEBL	Barcelona	Runway 07L-25R closed due to tunnel construction works	01-02-2018	15-02-2018	10,886
EIDW	Dublin	Lack of stands due to apron works	03-03-2018	09-03-2018	1,466
EDDK	Cologne	Runway 14L-32R reconstruction	07-04-2018	30-11-2018	5,486
LFMD	Cannes/Mandelieu	Air Race	18-04-2018	22-04-2018	1,722
LROP	Bucharest/Henri Coanda	Runway maintenance*	02-05-2018	20-06-2018	9,160
EGLL	London/Heathrow	Fly-past for 100 years of RAF	10-05-2018	10-05-2018	1,981
EKCH	Copenhagen	Runway 04L-22R pavement change	18-05-2018	22-05-2018	3,225
LFMN	Nice	Monaco Grand Prix	27-05-2018	27-05-2018	1,743
LIRP	Pisa/San Giusto	Runway works*	30-05-2018	22-07-2018	19,788
LFSB	Basel-Mulhouse	Art Basel	11-06-2018	14-06-2018	3,598
EGSS	London/Stansted	US Presidential visit	12-07-2018	13-07-2018	4,716
LF-	Paris/Charles de Gaule, Paris/Orly 5 Airports	Rehearsals and Ceremonies for Bastille day	13-06-2018	25-06-2018	7,027
LICC	Catania/Fontanarossa	Taxiway maintenance	24-06-2018	12-07-2018	13,739
LROP	Bucharest	Bucharest International Air Show	27-07-2018	28-07-2018	1,442
EVRA	Riga	Taxiway works	11-07-2018	12-07-2018	5,984
EFHK	Helsinki	Runway 22R-04L maintenance	21-08-2018	26-08-2018	6,549
LSZH	Zurich	Air display at Kloten	31-08-2018	13-09-2018	1,305
LFPO	Paris/Orly	Taxiway works*	11-09-2018	31-12-2018	49,884
LTBA	Istanbul/Ataturk	Air display	21-09-2018	21-09-2018	1,809
LFBO	Toulouse/Blagnac	Military air display at Toulouse/Franzacal	28-09-2018	30-08-2018	4,320
EHAM	Amsterdam/ Schiphol	Runway 18L-36R maintenance	10-09-2018	11-09-2018	9,808
LTBA	Istanbul/Ataturk	Opening ceremony of the new Istanbul Airport	27-10-2018	29-10-2018	15,589
EGLL	London/Heathrow	Closure of runway 09L exit points A9W/A9E	03-10-2018	21-12-2018	38,460
LICC	Catania/Fontanarossa	Taxiway maintenance*	31-10-2018	31-12-2018	18,406
LGAV	Athens	Full Scale Emergency Exercise as per ICAO/EASA provisions with full deployment of airport related emergency services	31-10-2018	31-10-2018	1,137
LGAV	Athens	Heavy maintenance works on parallel runways 03-21	01-11-2018	27-11-2018	35,284
LPPT	Lisbon	World War Centenary Military Ceremony	03-11-2018	04-11-2018	3,917
LEBL	Barcelona	Second phase of tunnelling works for railway connecting T2 and T1. Runway 07L-25R closed for safety reasons.	06-11-2018	25-11-2018	6,902
LIMC	Milano/Malpensa	Replacement of ILS on runway 17L	15-11-2018	23-11-2018	3,037

Table 6 Airport reported planned events 2018

* Events not reported via the usual channels of the Airport Corner.
[25] Only events with an impact of more than 1.000 minutes of ATFM delay were considered.

7 FLIGHT EFFICIENCY

This chapter provides a summary of the progress made on the implementation of the actions agreed in the joint IATA/CANSO/EUROCONTROL Flight Efficiency Plan[vi], drawn up in 2008, and responds to the requirements of the SES performance scheme.

The NM flight efficiency targets and objectives for 2018 included in the Network Performance Plan (NPP) 2015-2019[vii] and in the Network Operations Plan (NOP) 2018-2019/22 are listed below:

Route extension – airspace design (DES)

Target:

- achieve an improvement of the DES indicator by 0.57 percentage points between 2012 and 2019

Route extension – last filed flight plan (KEP)

Target:

- achieve a KEP target of 4.27% for the SES area and 3.99% for the NM area

Route extension – actual trajectory (KEA)

Target:

- achieve a KEA target of 2.69% for both SES and NM areas

Increase the CDR1/2 usage (CDR-RAI and CDR-RAU)

NM Objective:

- increase the CDR availability (CDR-RAI) and CDR usage (CDR-RAU) by 5% between 2015 and 2019

Flight efficiency indicators are monitored for pure airspace design and for flight planning. The downward trend evolution of those indicators since the beginning of 2011 is shown on Figure 43.

The evolution recorded on the route extension based on the last filed flight plan during 2018 was positively impacted by the implementation of Free Route Airspace. Nevertheless, negative impacts were still recorded as a result of the industrial actions, social issues that led to reduced capacities and re-routings to avoid capacity constrained and avoided/closed areas due to crisis situation. This evolution continues to demonstrate the necessity to provide sufficient capacity constantly to further improve the flight planning indicator and to reduce the gap with the airspace design indicator.

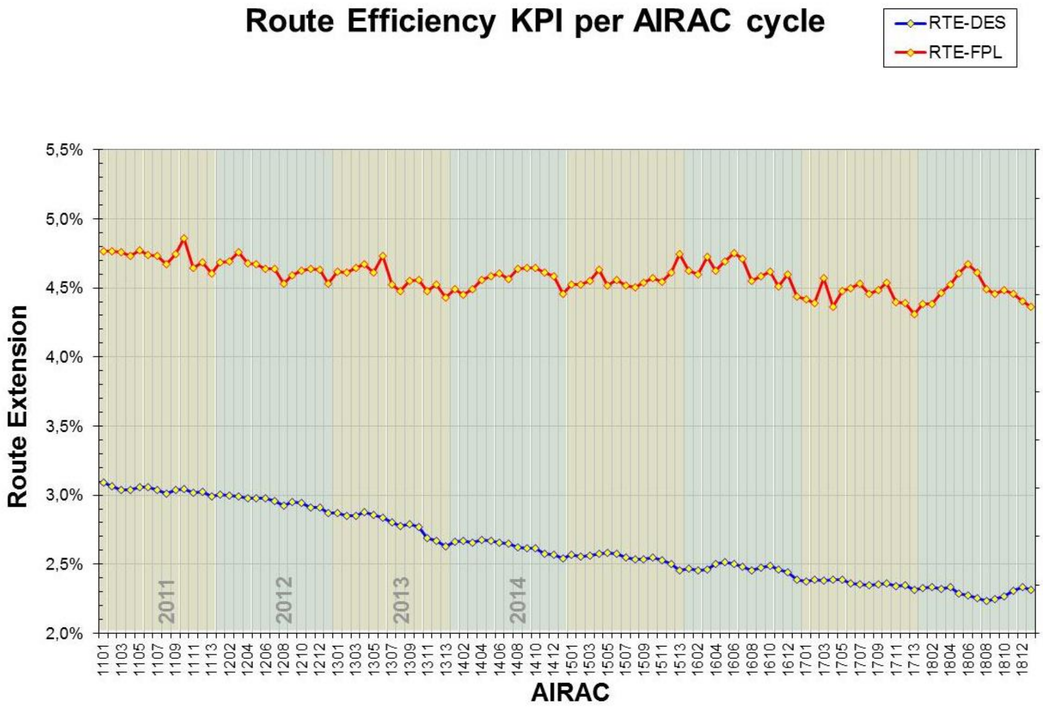


Figure 43: Route efficiency KPI per AIRAC cycle

A number of events in 2018 affected the network and had direct consequences on the flight efficiency evolution:

- Overall crisis situation in Ukraine that lead a significant number of flights to avoid the entire Ukrainian airspace moving to neighbouring countries (Turkey, Bulgaria, Romania, Poland, Slovakia, etc.); as a result of the Ukrainian crisis adjacent ACCs/ UACs were on-loaded by Far Eastern traffic avoiding the Ukraine airspace leading to increased route extensions.
- Closure of Libyan airspace for over flights due to the security situation required procedures with impact on flight efficiency for traffic between Europe and Africa re-routed via Egypt and Tunisia.
- Avoidance of Syrian and Iraqi airspace due to the security situation with impact on flight efficiency for traffic between Europe and Middle East and Asia re-routed via Iran and Turkey with additional impacts on the flows from the Ukrainian crisis situation.
- Several French ATC industrial actions in March, September, October and November required regulations in French ACCs and protective measures in neighbouring ACCs, with impact on flight planning route extension
- Widespread capacity and staffing issues across the network required a high number of regulations and/or level-cap scenarios at: Karlsruhe UAC, Maastricht UAC, Prague ACC, Brest ACC, Marseille ACC, Langen ACC, Reims ACC, Nicosia ACC, Budapest ACC.

7.1 AIRSPACE DESIGN

As part of the Flight Efficiency Plan, intensive work was undertaken by States and ANSPs in close cooperation with NM to develop and implement enhanced airspace design solutions, with over 150 airspace improvement packages being developed and implemented in the 12 months prior to summer 2018. As a result, the route extension due to airspace design (RTE-DES) continued its downward trend throughout the year, reaching its lowest level ever in August 2018 at 2.23%.

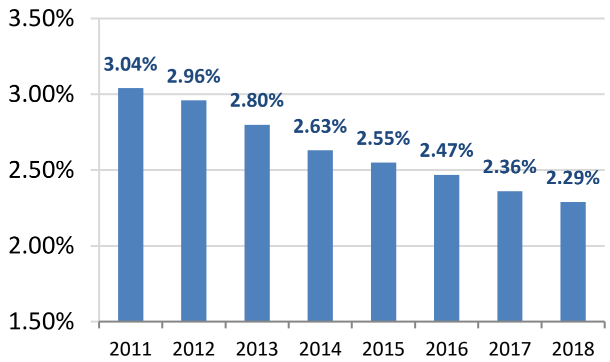


Figure 44: yearly evolution of the airspace design indicator (RTE-DES)

The average route extension due to airspace design, RTE-DES (Figure 47) decreased from 2.36% in 2017 to 2.29% in 2018, enabling an average potential daily saving of nearly 2,100 nautical miles.

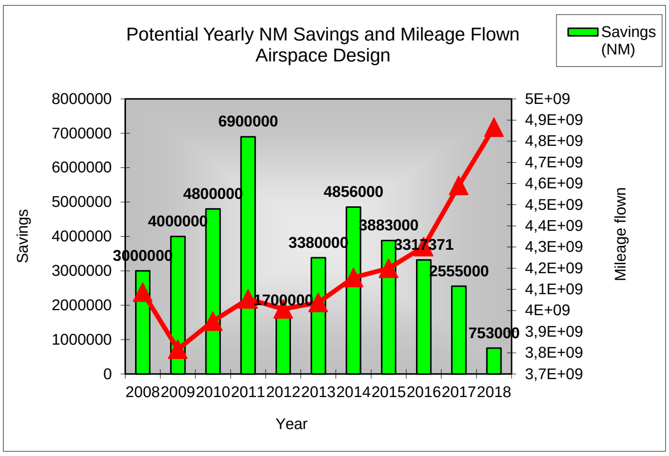


Figure 45: Potential yearly savings/ losses in nautical miles (NM) due to airspace design

Over the reporting year, this represents a potential saving of 753000 nautical miles (Figure 48), approximately 4.5 kilotons of fuel, reduced emissions of 15 kilotons of CO_2, or 3.8 million Euros when compared to 2017.

7.2 AIRSPACE CHANGES VS. FLIGHT PLANNING

The flight planning indicator (KEP) measures the length of the flight planned trajectory compared to the great circle (route extension). It reflects inefficiencies in the use of the airspace (due to RAD restrictions, CDR availability, inefficient flight-planning etc.), but also user preferences for cheaper rather than shorter routes.

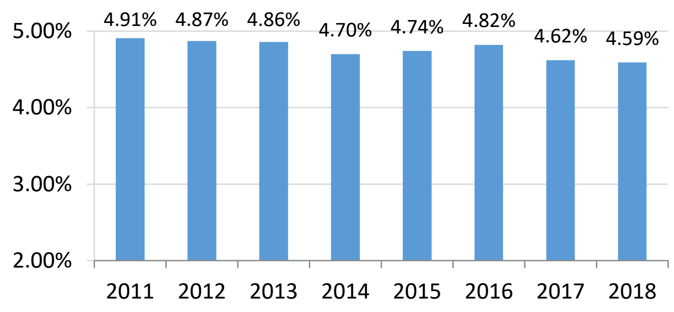


Figure 46: Yearly evolution of flight-planning indicator (KEP)

The average route extension based on the latest filed flight plan (KEP) decreased from 4.62% in 2017, to 4.59% in 2018 (Figure 46) for NM area. This is above the KEP 2018 targets of 4.27% for SES area and 3.99 % for NM area.

Figure 47 shows the corresponding yearly savings / losses and the relationship with the mileage flown over the Second Reference Period (RP2) of the SES Performance scheme.

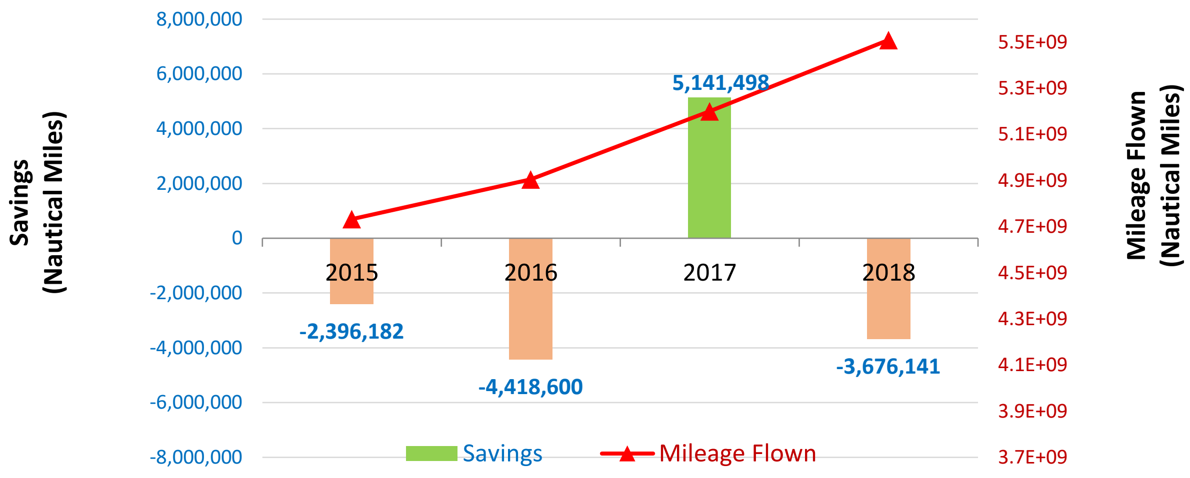


Figure 47: Yearly savings/ losses in nautical miles (NM) due to improved flight planning efficiency

The average flight-planned distance decreased when compared to 2017, resulting in additional 3.67 million nautical miles flown over the whole year. This means an average daily increase of more than 10000 nautical miles. Over the year, this represents losses of approximately 21.6 kilotons of fuel, increased emissions of 72 kilotons of CO_2, or extra 18 million Euros spent when compared to 2017.

The trend also reflects the combined effect of industrial actions, special events (e.g. Ukraine crisis situation, Libyan airspace closure, etc.) and technical problems on the network and adverse weather. Despite all those factors, the trend is positive and the airspace improvements made helped to contain all the adverse effects.

This situation proves the good work done in improving flight-planning options for the operators but emphasises again that more efforts must be made to improve the efficiency of the airspace utilisation and to constantly provide sufficient capacity thus ensuring that the indicator based on the latest filed flight plan follows a similar trend to the airspace design indicator.

7.3 ACTUAL TRAJECTORY

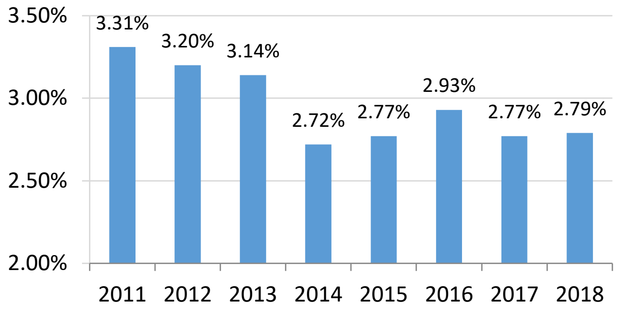


Figure 48: Yearly evolution of the actual trajectory indicator (KEA)

The actual trajectory indicator (KEA) increased to 2.79% (Figure 48) for the NM area, thus not meeting the target (2.69%) for both SES and NM areas.

The continuous expansion of the Free-Route Airspace (FRA) (including continuous expansion of cross-border FRA) is a major factor in the positive evolution of the environment indicators (KEP and KEA).

Figure 49 shows the corresponding yearly savings / losses and the relationship with the mileage flown from the start of the Second Reference Period (RP2) of the SES Performance scheme.

The average actual distance increased when compared to 2017, resulting in additional 5.7 million nautical miles flown over the whole year. This means an average daily increase of more than 1500 nautical miles. Over the year, this represents losses of approximately 34.2 kilotons of fuel, increased emissions of 114 kilotons of CO_2, or extra 28.5 million Euros spent when compared to 2017.

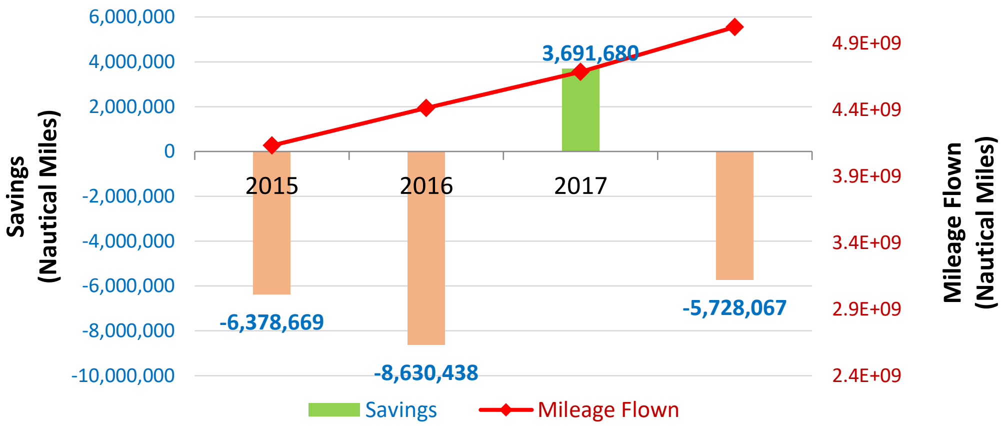


Figure 49 - Yearly savings/ losses in nautical miles (NM) due to improved actual trajectory efficiency

7.4 CONDITIONAL ROUTES (CDR)

CDR availability is an important element when considering the ASM in the Network Operations context. The chart below shows little changes in absolute figures for the evolution of CDR development as elements of the network in 2018 compared to 2017 and the previous years . This is due mainly to changes in CDR categories with many CDR1/2 to permit night routes opened and to the continuous network improvement process (covered by ERNIP part 2).

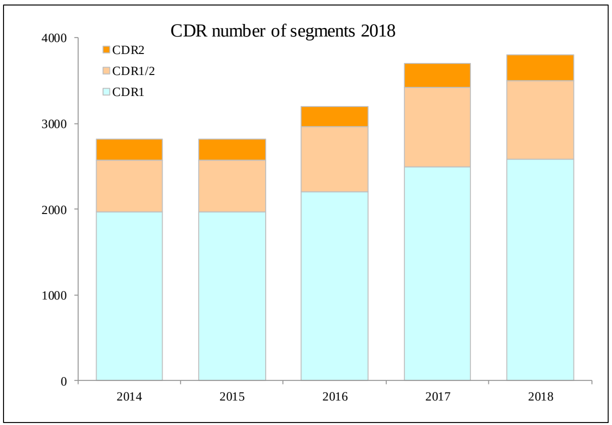


Figure 50: Evolution of CDR availability in 2018

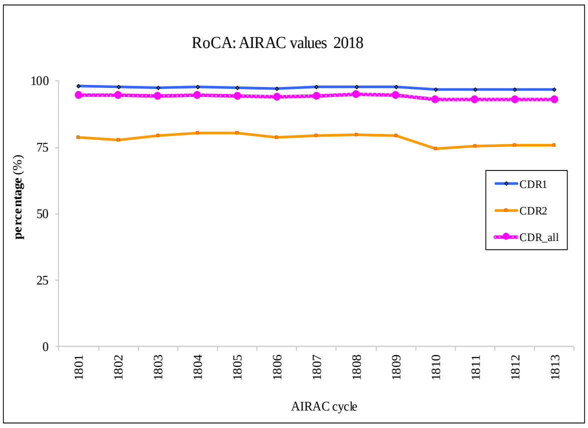


Figure 51: Rate of CDR availability (RoCA) in 2018

RoCA for CDR1 and CDR1/2 categories had a stable high value (97%) over the entire year while RoCA for CDR2 is oscillating between 75% and 80% with an average of 78%.

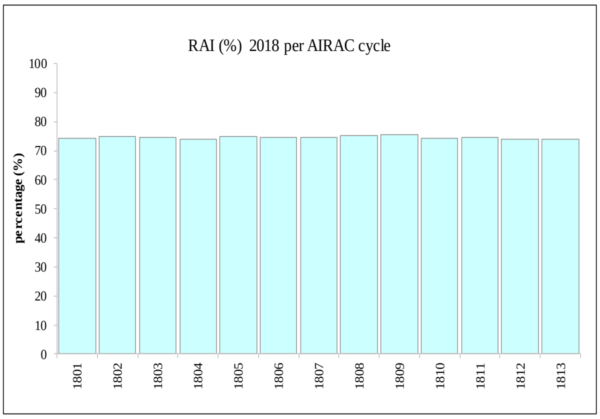


Figure 52: RAI (%) 2018 per AIRAC cycle.

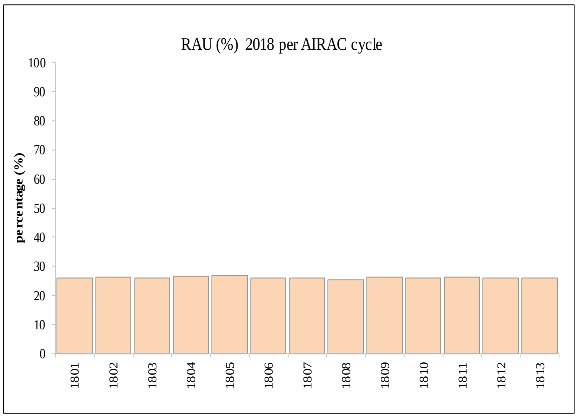


Figure 53: RAU (%) 2018 per AIRAC cycle

The Rate of Aircraft Interested (RAI) that planned the available CDR was relatively constant at a value of approx. 75% for the entire year 2018.

The Rate of Aircraft actually Using (RAU) CDR was lower (26%). This is the result of both the ATC intervention for various reasons (expedite traffic, weather, etc.) as well as due to the expansion of FRA implementation in ECAC, making many CDRs no longer a better solution for flying

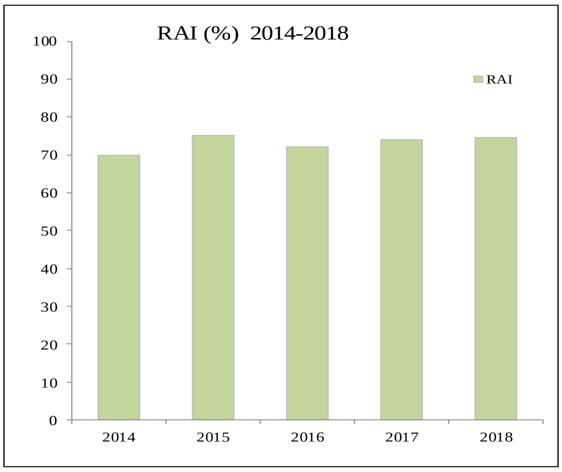


Figure 54: Five year RAI evolution

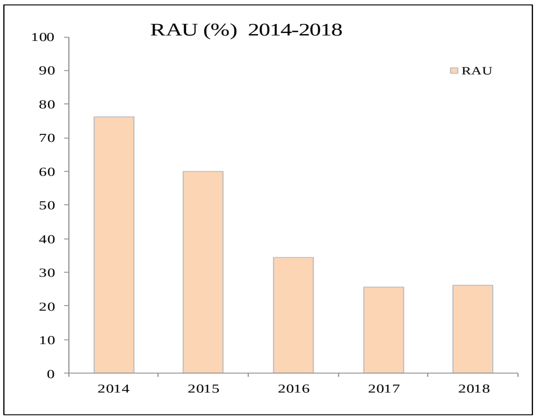


Figure 55: Five year RAU evolution

The charts of RAI and RAU evolution over the past 5 years in Figure 54 and 58 indicate the tendency to use less and less the CDR, since there are today better options in FRA or the DCTs. Therefore the NM objective of increasing the availability (RAI) and use (RAU) of CDRs by 5% between 2015-2019 became obsolete.

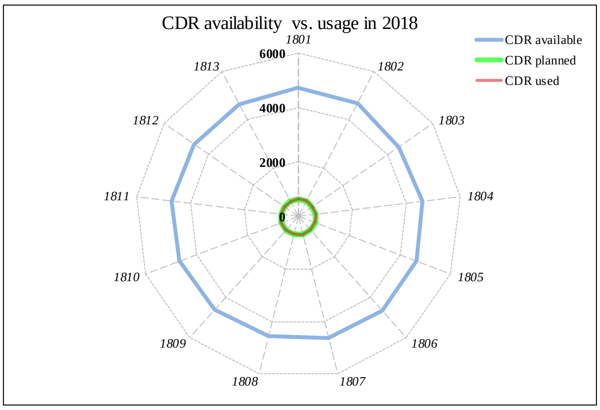


Figure 56: CDR availability vs. usage in 2018

Figure 56 shows the number of CDR available for flight planning (blue line), the number that were actually flight planned (green line) and the number that were actually flown (red line). The green and red lines overlap. Approx. 15% of available CDR were used in 2017.

The numbers indicating the CDR used and planned versus the CDR available show in 2018 an almost constant difference with a huge gap between availability and utilisation, a similar trend to 2017. The explanation is that in 2018 the FRA airspace in ECAC was extended significantly adding FRA Germany to the already existing FRA regions. As a result the route network and implicitly the CDRs in these areas have no more relevance.

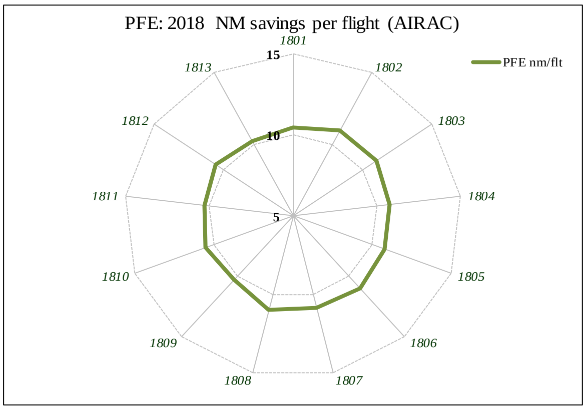


Figure 57: PFE: 2018 Monthly Distance savings (nautical miles per flight)

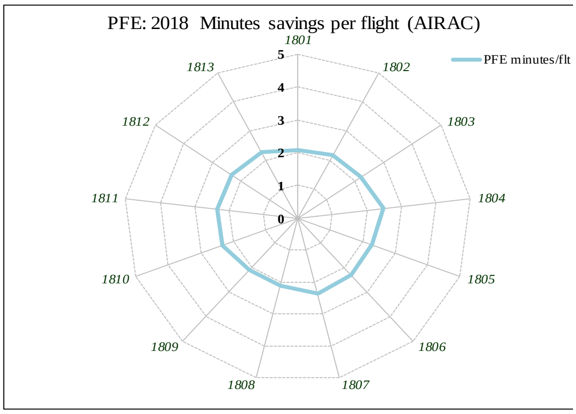


Figure 58: PFE: 2018 Monthly time savings (minutes per flight)

The savings per flight in distance and in time due to CDR are strongly dependent on the network opportunities offered by the CDR but in reality the actual traffic is not always able to follow the planned trajectory that would maximize the efficiency due to various causes outside the flight planning process. With the current advances in airspace configurations, Free Route Airspace and Direct routes implemented in more ECAC regions the CDRs lost their weight in improving routeing solutions.

Potential Flight Economy (PFE) can be realised when using the available CDRs for planning. This is influenced mainly by the CDR availability rate (RoCA) and the awareness/ability/ willingness of the Aircraft Operators to consider the available CDRs in their FPL solutions. The indicator shows how far the real planned trajectories are from the optimum ones.

Concerning the actual traffic, the PFE is calculated with the actual flown CDRs from those available. The values may differ from the planned ones for a number of reasons (ATC intervention for direct/rerouting, delayed departure miss the CDR uptake and forcing to alter the initial FPL, weather, etc.). When making the comparison and the values are smaller, it can also signify that less potential economy is obtained when the initial trajectories are closer to optimal. The diagrams below depict the aggregated values calculated for all CDR types (CDR1, CDR1/2, CDR2) averaged by month:

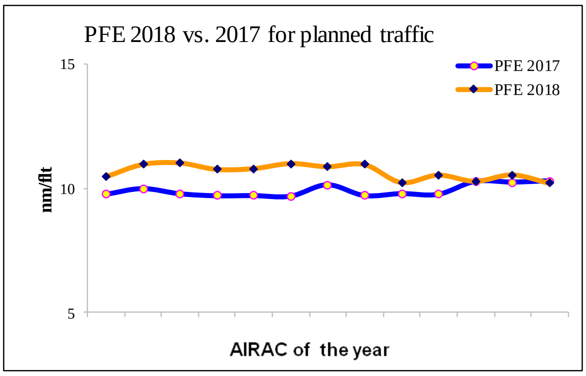


Figure 59: PFE 2018 vs. 2017 for planned traffic

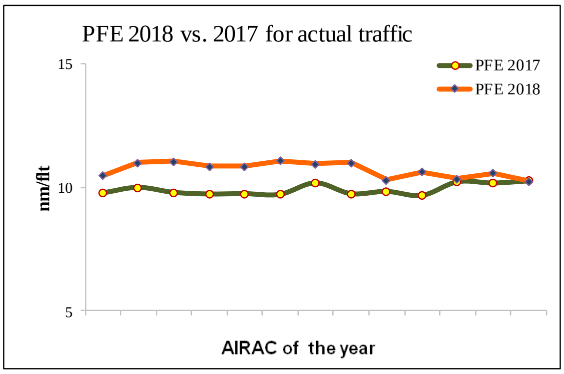


Figure 60: PFE 2018 vs. 2017 for actual traffic

Comparing the Potential Flight Economy (PFE) year on year 2018 with 2017 one can see that the evolution in 2018 has very little variation over the year due to low values of CDR used vs. CDRs available for which potential economy is calculated. The actual gain in 2018 is following in general the planned trend with similar evolution as the planned traffic.

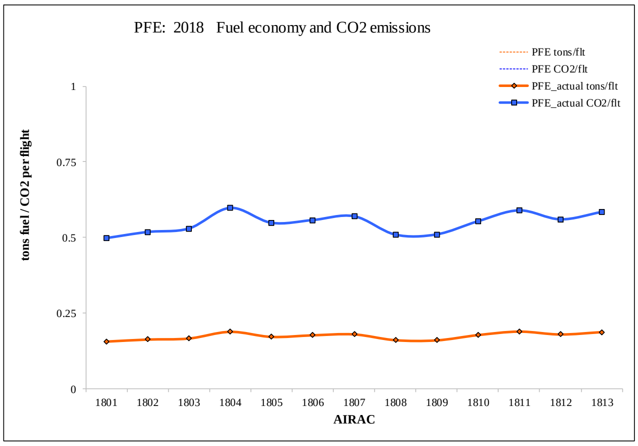


Figure 61: PFE: 2017 Fuel economy and CO_2 emissions

The environmental indicators of PFE translated in fuel savings and reduced CO_2 emissions illustrated in the picture on the left have been calculated using the ICAO methodology for fuel burned and CO_2 emissions. The curves show the effect of less CDR usage both for planning and actual flying for the causes mentioned above

7.5 FREE ROUTE OPERATIONS

By the end of 2018, 54 ACCs have either fully or partially implemented Free Route Airspace operations.

Free Route Airspace implementation	Lisbon ACC
	Oslo, Stavanger, Bodo, Tampere, Tallinn, Riga ,Copenhagen , Malmo and Stockholm ACCs as part of NEFRA
	Shannon ACC
	Vilnius ACC
	Budapest ACC
	Beograd, Zagreb, Vienna and Ljubljana ACCs as part of the- South East Common Sky Initiative (SECSI) FRA
	Rome, Padua, Brindisi and Milan ACCs as part of FRA IT
	Malta ACC
	Skopje ACC
	Tirana ACC
	Tibilisi ACC
	Chisinau ACC
	Yerevan ACC
	Minsk ACC
	North East Karlsruhe UAC
Night Free Route Airspace implementation	Sofia and Bucharest ACCs as part of Danube FAB
	Maastricht UAC night and weekends
	Kyiv, Lviv , Odesa, Dnipropetrovsk ACCs
	Karlsruhe UAC
	Bremen ACC
	Munich ACC
	Bratislava ACC
DCT based implementation	Reims, Brest, Bordeaux, Paris, Marseille ACCs
	Madrid ACC
	London and Prestwick ACCs
	Geneva and Zurich ACCs
	Athens and Macedonia ACCs
	Prague ACC
	Warsaw ACC
	Nicosia ACC

Table 7 Free Route Airspace Operations Implementations

There were increasing trends for ACCs to conduct cross border operations and to lower the base level of FRA to the maximum extent possible. NM is closely associated to the FRA implementation through airspace design, airspace validations, definition of network airspace utilisation rules, overall network interconnectivity and interoperability, simulations and NM systems upgrades.

During 2018 the following implementations were completed:

SECSI - South East Common Sky Initiative – Wien, Ljubljana, Zagreb and Beograd ACCs, Danube FAB 3A extend Sofia CTA to H24 on Seasonal basis above FL175. FRA Germany, H24 within the North East Karlsruhe UAC (above FL285/315); b.night within South West (above FL245/315); night at Munich ACC (FL245 - FL315); d.night at Bremen ACC (FL245-FL285). FRA Italy - extended the FRA from FL335 down to FL305, at Milano, Roma, Padua and Brindisi ACCs. Malta ACC became H24 FRA above FL305, while Minsk ACC commenced night operations from FL305 to FL660, Yerevan ACC became H24 FRA FL195 - FL660. Maastricht UAC changed to night and weekend FRA above FL245. SEENFRA night cross-border FRA between Budapest, Bucharest, Sofia and Bratislava ACCs started from various levels to - FL660. FRA Ukraine - L'viv ACC H24 FRA changed to FL275 to FL660.

The following map shows the European Free Route Airspace deployment status as of end 2018.

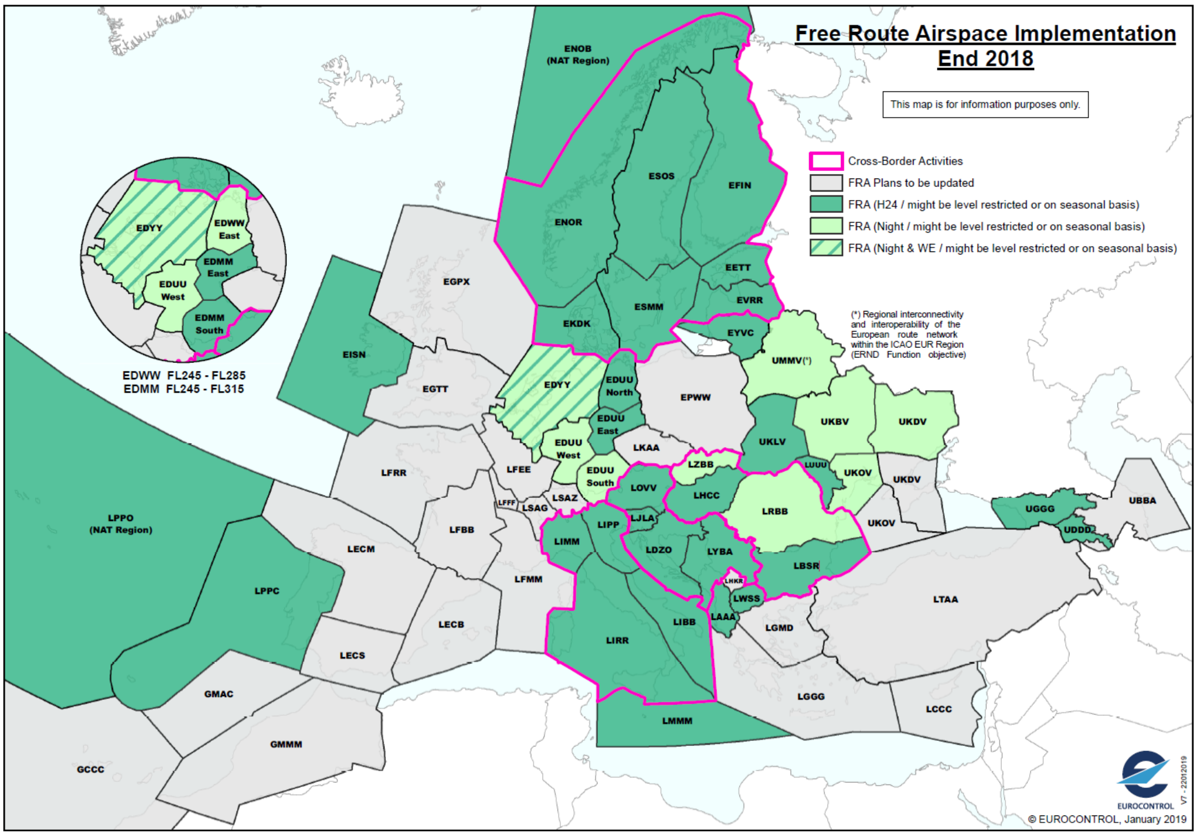


Figure 62: Map – Free Route Airspace Deployment by end 2018

7.6 ROUTE AVAILABILITY DOCUMENT (RAD)

The Route Availability Document (RAD) is a tool that addresses how the European network airspace may be used. According to the Commission Regulation (EU) No 255/2010[viii] the scope of the RAD is to be a common reference document containing the policies, procedures and description for route and traffic orientation.

The Network Manager Implementing Rule (Commission Regulation (EU) No 677/2011)[ix] makes a clear reference that the European Route Network Improvement Plan shall include route network and free route airspace utilisation rules and availability.

The airspace design and airspace utilisation aspects were brought closer by the established multi-disciplinary Network Manager RAD Team guided by the Operational Stakeholders RAD Management Group.

The actions performed by the NM RAD Team have facilitated a pragmatic refinement of the RAD during 2018, with full cooperation of Operational Stakeholders, aiming to overcome weaknesses in airspace design and ATM system functionality and to ensure application of the remaining restrictions only where and when required.

The major RAD evolutions and developments in 2018 focusing particularly at Network level and covering the entire NM area of responsibility were as follows:

- Further adaptation of the time expression and harmonisation in entire RAD;
- Gradual adaptation of RAD to meet the FRA requirements and refinement of restrictions based on airspace volumes;
- Adaptation and change of restrictions identification rules in RAD;
- Adaptation of Appendix 4 DCT and Utilization availability periods;
- Alignment of Appendix 6 with CACD database;
- Alignment of Appendix 7 FUA Restriction with CACD database;
- Management of Complex FUA restrictions from Appendix 7;
- Inclusion of permanently unavailable RSAs in Appendix 7;
- Annex Pan-Europe restriction applicability versus utilisation;
- Adaptation of all RAD restrictions with seasonal period at AIRAC date;
- Improvements in “Last minutes” RAD changes and “Daily” use of Increment File;
- Improvements in RAD Annex for Special Events;
- Improvements in data structure and format, and change management based on RAD - AURA@n-CONECT grammar;
- NM Release development related to Airspace Utilisation Rules and Availability (AURA) interactive process via the NOP and use of the NOP Portal as a collaborative platform to build the RAD - AURA@n-CONECT;
- Improvement of Dependent Applicability Function (RAD) in NMOC Systems;
- Further developments of the NM DCT / CDR mapping tool;
- Publication of B2B PTRs xls file;
- Completion of publication of harmonised text in regard to promulgation of RAD via the State AIPs;
- Adaptations of RAD Terms and Definitions in NM Documentation;
- Run of a Network impact assessment of the RAD restrictions implemented in the States and contributions to production of RAD Network Impact assessment study Document.

The other RAD evolutions and developments in 2018 included the following aspects (not exhaustive):

- Further development of the RAD DCT Chart;
- Continuation of improvements in data structure and format, and change management based on RAD - AURA@n-CONECT grammar;
- Further adaptations in all RAD Harmonization Rules based on RAD - AURA@n-CONECT developments;
- Continuation of harmonisation of terminology and definitions of restrictions;
- Continuation of improvements in RAD availability (publication) to users;
- Continuation of rationalisation of restrictions expression;
- Continuation of the pdf RAD publication;
- Improvements in coordination of RAD airspace data reference versus airspace changes.

Further RAD structure, process, and supporting improvement measures have been proposed for implementation in 2019 such as:

- Adaptation of Appendix 3 City Pair description;
- Gradual improvement in RAD Utilization definition, adaptation of the expressions in the RAD and harmonisation in entire RAD;
- Further improvement and fine-tuning of a Network impact assessment of the RAD restrictions implemented in the States.
- Further NM Release developments related to Airspace Utilisation Rules and Availability (AURA);
- Implementation in real operations of RAD via AURA@n-CONECT;
- Continuation of publication of EU / EURO restrictions;
- Continuation of publication of FRA DCT restrictions;
- Continuation of publication of B2B PTRs;
- Re-definition of the CDM process on the acceptance of proposed RAD restrictions in accordance with the justification, assessment results and objective goal of the proposed RAD restrictions; Assess the need, the effect and traffic impacted by the request to have new RAD restrictions introduced;
- Definition of a new process for the “Last minute” changes:
    - Perform assessment of the proposed RAD restrictions and subsequently proposed “Last minute” changes;
    - Allow exemptions in the “Last minute” changes eligibility criteria.
- Establishment by NM / States / FABs / ANSPs of a post-ops process to continuously re-evaluate the existing RAD restrictions and if additional justification not provided to ask for that RAD restrictions suppression;
- Further simplification of the RAD restrictions:

8 NETWORK MANAGER

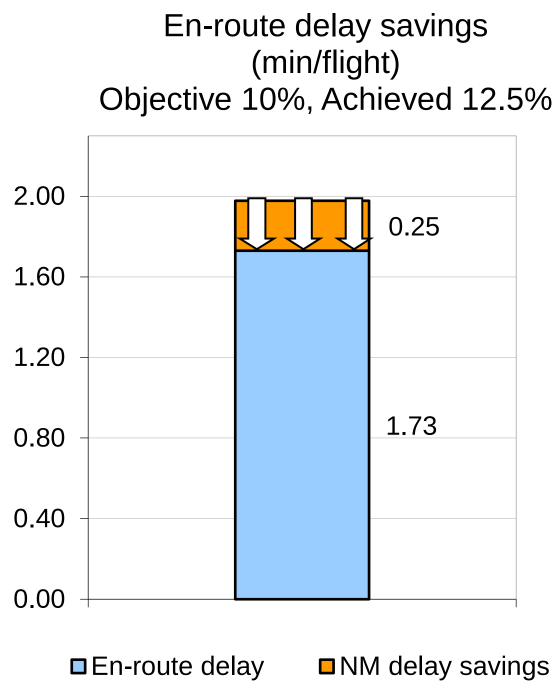
In addition to the network targets defined for 2018, the NM Performance Plan defines a set of internal NM performance objectives/targets, to measure NM's contribution to the ATM network performance. In the Capacity performance area, NM has the target to reduce the en-route ATFM delays by 10%.

NM Operations Centre (NMOC) looks for opportunities to reduce the delays by means of proposing alternative routes (RRPs) to the airlines, manually optimising the calculated time over (CTO) or take-off times (CTOT) (these are the direct delay reduction actions). The manual CTOT changes are performed in conjunction with the FMPs/AOs and are therefore regarded as confirmed delay reductions. Re-route proposals can only deliver delay benefit if the AO accepts the proposal - this is monitored in post-ops. These techniques reduce delays at individual flight level and deliver further delay reductions at network level through the CASA optimisation algorithm (indirect 'snowball' effect). While it is currently possible to measure the direct delay reductions initiated by NMOC, it is not possible to quantify the indirect delay reduction effect of the direct actions. The amount of delay reduced by NMOC pre-tactical planning process and the applied scenarios cannot be quantified either.

8.1 CAPACITY (DELAY REDUCTIONS)

NM's efforts to reduce delays in 2018 increased in proportion to the overall en-route delay increase. Delay savings were calculated conservatively, only taking into account accepted Re-routeing Proposals (RRPs) and NMOC direct action (i.e. Force CTO/CTOT and Override Slot).

In 2018, NMOC saved 3.4 million minutes of ATFM delay, 80% of all savings were on en-route delays and 20% on airport delays.



En-route savings exceeded 2.7 million minutes from direct actions in NMOC (2.5 million minutes), and RRPs proposed and followed by airlines (190,000 minutes), equivalent to 0.25 minutes per flight – without this, the delay in 2018 would have been close to 2 minutes per flight. This equates to 12.5% of the annual network delay, meeting the 10% target defined in the NPP.

Figure 63 NM En-route Delay Savings in 2018

8.2 ENVIRONMENT (FLIGHT EFFICIENCY)

As part of Flight Efficiency Plan, intensive work has been undertaken by States and ANSPs in close cooperation with NM to develop and implement enhanced airspace design solutions, with over 100 airspace improvement packages being co-ordinated at network level and implemented during the 12 months of 2018. These improvement measures reduced significantly the actual losses recorded as a result of number of events (see 3.5) which had direct consequences on the flight efficiency evolution. The list below provides an overview of the major enhancements implemented in 2018 (up to and incl AIRAC 1813).

- **Armenia**
  - ARMFRA Free Route Airspace Yerevan ACC - Step 2.
- **Austria / Bosnia & Herzegovina / Croatia / Montenegro / Serbia / Slovenia**
  - SECSI - South East Common Sky Initiative (cross-border FRA operation between SAXFRA and SEAFRA).
- **Bulgaria**
  - DANUBE FAB - Phase 3a (H24 FRA on seasonal basis above FL175.)
  - New Plovdiv TMA.
- **Cyprus**
  - Nicosia Direct Route Airspace - Phase 2B.
- **Estonia**
  - Sector changes Tallinn FIR.
- **France**
  - IAM Interface Aix Marseille re-organisation.
  - S-WAFLE - South West Adaptation Flight Level Evolution - Phase 2.
  - Reims sector 'YB' creation.
  - Brest ACC re-organisation - Step 1.
  - Brest ACC re-organisation - Step 2.
- **France / Spain**
  - Barcelona, Madrid, Bordeaux Interface, BAMBI.
  - ESSO - Espace Superieur du Sud Ouest (Bordeaux ACC reorganisation).
- **Germany**
  - Munich ACC - OASE Phase 1.
  - Free Route Airspace/ FRA EDUU North (Rhein UAC, Munich ACC, Bremen ACC).
- **Greece**
  - Direct Route Airspace Greece H24 - Phase 3a.
  - Greek Airspace reorganization - Phase 1.
  - GOLDO Dualisation (in support of Istanbul New Airport).
  - Direct Route Airspace Greece H24 – Phase 3a/ 3b.
  - Implementation of PBN/ SBAS and Approach procedures Athinai FIR.
- **Italy**
  - FRA-IT Free Route Airspace Italy, Phase 4.
  - Airspace structure improvement Brindisi FIR, Milano FIR and Roma FIR.
  - Olbia/Alghero CTR re-organisation and new Sardegna CTA implementation.
- **Lithuania**
  - Vilnius ACC sector reorganisation.
- **Maastricht UAC**
  - DECO airspace re-design project.

- FRAM2 - Phase 2 (expansion of existing Night Free Route Airspace to NIGHT and Weekends).

- **Malta**
  - Free Route Airspace Malta - Phase 3b.
  - INTRAC - New Terminal Routing Airspace Concept Malta airport.
- **Norway**
  - New Norway ACC Sector 27.
- **Norway / Denmark**
  - ENSV10 sector re-alignment.
- **Poland**
  - New military area Warszawa FIR.
- **Portugal**
  - Porto TMA expansion - Lisboa FIR.
  - User-Preferred Trajectories Santa Maria FIR - Phase 1.
- **Serbia**
  - Lower airspace re-organisation Beograd FIR - Step 2b.
- **Spain**
  - Barcelona TMA - Phase 1a.
  - Barcelona TMA - Phase 1b.
- **Switzerland**
  - Zurich ACC - Sector West Re-Organization.
- **Turkey**
  - RNAV/RNP procedures for Ankara/ Esenboga airport.
  - SMART- Systematic Modernization of ATM Resources in Turkey, Phase 4a.
- **UK**
  - Swanwick Airspace Improvement Programme (SAIP) - Airspace Deployment 4 (AD4).
- **Ukraine**
  - FRAU Free Route Airspace Ukraine, Step 1 (Sc 1b) - Phase 1.

9 ATFM COMPLIANCE

9.1 ATFM DEPARTURE SLOTS

The overall percentage of traffic departing within their Slot Tolerance Window (STW) was 92.2% in 2018, meeting the target of 80%. However, many airports did not meet the target (see ATFM statistics dashboard - ATFM Compliance Monitoring – Departure Compliance [x]). It is an improvement over 2017 where the compliance percentage was 91%.

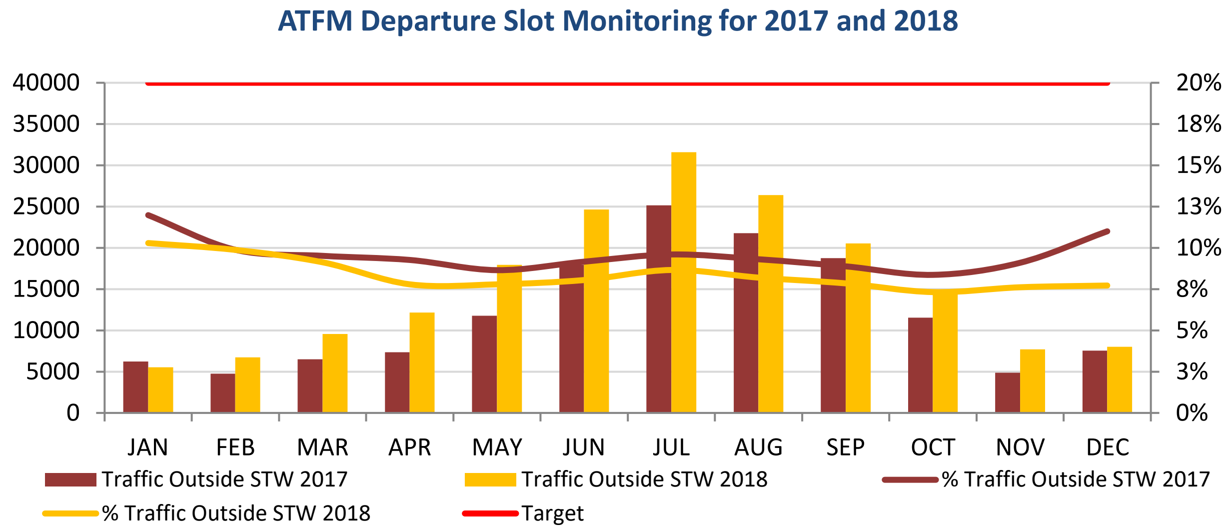


Figure 64: ATFM Departure Slot Monitoring for 2017 and 2018[26]

[26] Geographical Zone : NM or Adjacent Member States

9.2 ADHERENCE TO FLIGHT PLAN SUSPENSIONS

The percentage of flights suspended by FAM (Flight Activation Monitoring) but which were activated by airborne data received whilst the flight was temporarily decreased to 0.20% of all departures. Figure 65 shows the top airports where such situations occurred, as well as the percentage of these flights within the total number of flights at that airport. The introduction of Airport CDM has proven to be the most effective measure in bringing down the number of such flights. Amsterdam/Schiphol introduced CDM in May 2018 and the airport recorded 3,786 fewer unduly activated flights than 2017.

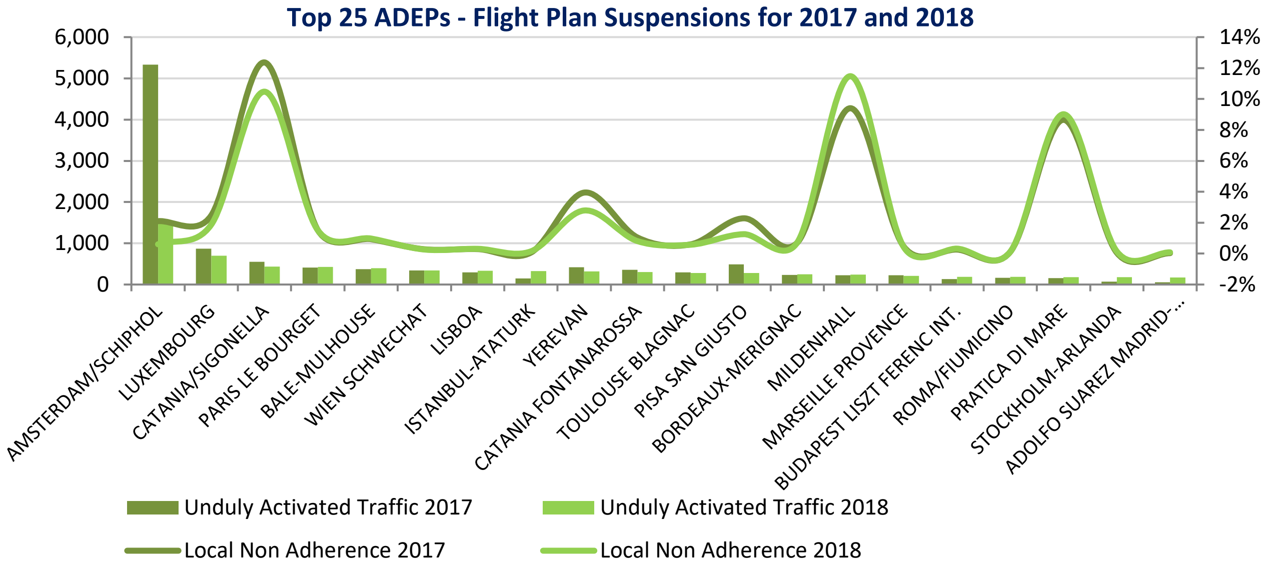


Figure 65: Top 20 ADEPs - Flight Plans Suspensions for 2017 and 2018[27]

[27] Geographical Zone : Eurocontrol or EUR28 Member States

9.3 ATFM EXEMPTIONS

The overall European ATFM exempted flights decreased in 2018 to 0.58% of all departures (0.61% in 2017), below the target of 0.6%. There were 16 EUROCONTROL Member States in 2018 that granted exemptions in excess of 0.60% of the State's annual departures (EU Member States will be formally notified). NM will discuss any network considerations with the State and service provider concerned.

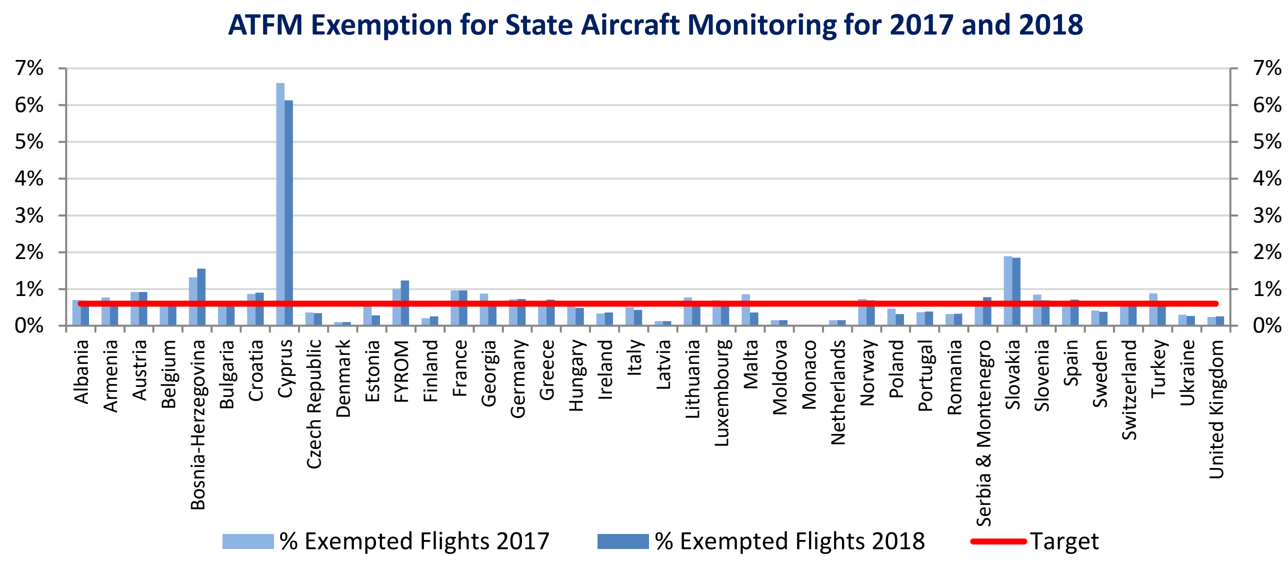


Figure 66: ATFM Exemptions for State Aircraft Monitoring for 2017 and 2018[28]

[28] Geographical Zone : Eurocontrol or EUR28 Member States

9.4 MISSING FLIGHT PLANS

Figure 67 presents the evolution of the number of Missing Flight Plans (APL Flights), identifying those flights that entered the European airspace without a flight plan (i.e. no initial flight plan was filed successfully in IFPS) and an ATS Unit filed the Flight Plan. The percentage of such flight plans decreased to 0.05% (0.07% in 2017).

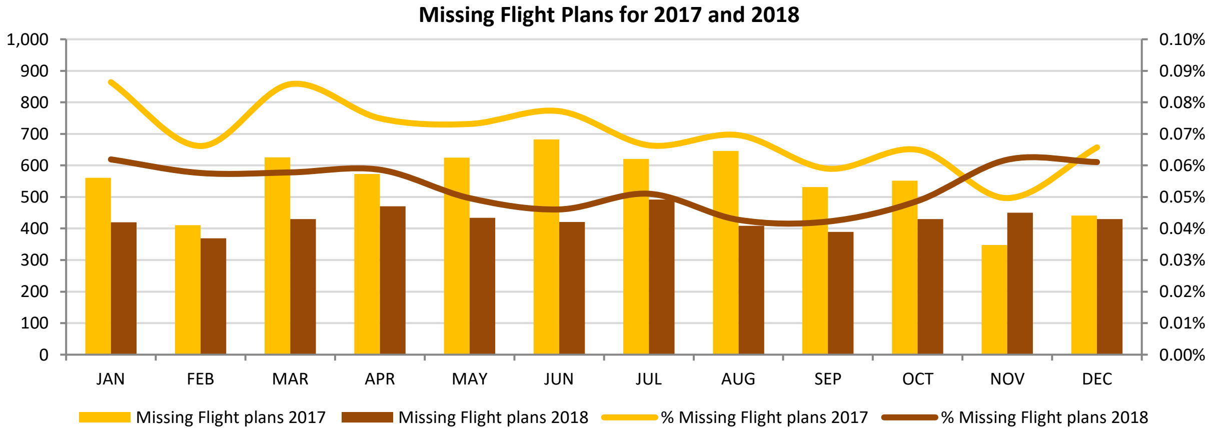


Figure 67: Missing Flight Plans for 2017 and 2018[29]

[29] Geographical Zone : ADEP or ADES NM Member States

9.5 MULTIPLE FLIGHTS

NM is using the data from Flight Activation Monitoring to identify possible multiple flight plans by measuring the number of flight plans received for which no subsequent activation or airborne information is received. Figure 68 presents the evolution of numbers and proportion of these flights within the total traffic. The percentage of these flights remained at 0.23%, when comparing to 2017. NM reviews the causes and the network impact of such cases and contacts the airlines or flight plan originators when necessary.

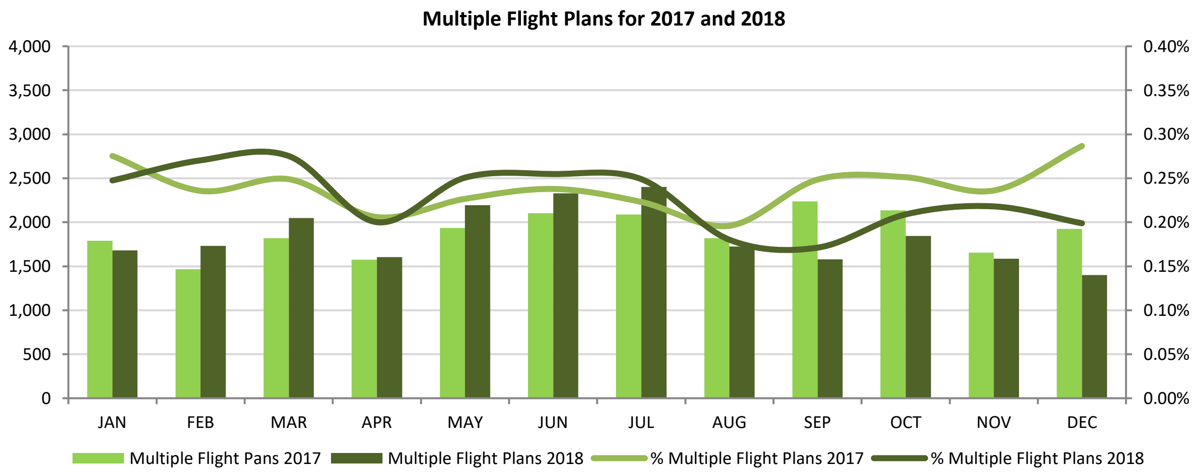


Figure 68: Multiple Flight Plans for 2017 and 2018

10 REFERENCES

i Reporting Assumptions and Descriptions Document
http://www.eurocontrol.int/articles/network-operations-monitoring-and-reporting

ii EUROCONTROL Air Navigation Inter-site Acronym List (AIRIAL)
http://www.eurocontrol.int/airial/definitionListInit.do?skipLogon=true&glossaryUid=AIRIAL

iii Transition Plan for major Projects in Europe 2017-2018 and Transition Plan for major Projects in Europe 2018-2019

iv European Network Operations Plan 2018 – 2019/22 https://www.eurocontrol.int/publications/european-network-operations-plan-2018-2022

v Airport Collaborative Decision Making (A-CDM) Impact Assessment. An independent study, conducted on behalf of EUROCONTROL, assessing both the local and network impact of A-CDM implementation completed in 2016.
https://www.eurocontrol.int/publications/a-cdm-impact-assessment

vi Flight Efficiency Plan
https://www.eurocontrol.int/articles/airspace-developments-and-flight-efficiency-plan-fep

vii Network Performance Plan 2015 -2019
http://www.eurocontrol.int/sites/default/files/publication/files/npp-report-2015-19.pdf

viii Common Rules on Air Traffic Flow Management (255/2010)
http://www.skybrary.aero/index.php/Regulation_255/2010_-_Common_Rules_on_Air_Traffic_Flow_Management

ix Detailed rules for the implementation of ATM network functions
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x Air Traffic Flow Management Statistics Dashboard
https://www.eurocontrol.int/articles/network-operations-monitoring-and-reporting

Network Manager
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